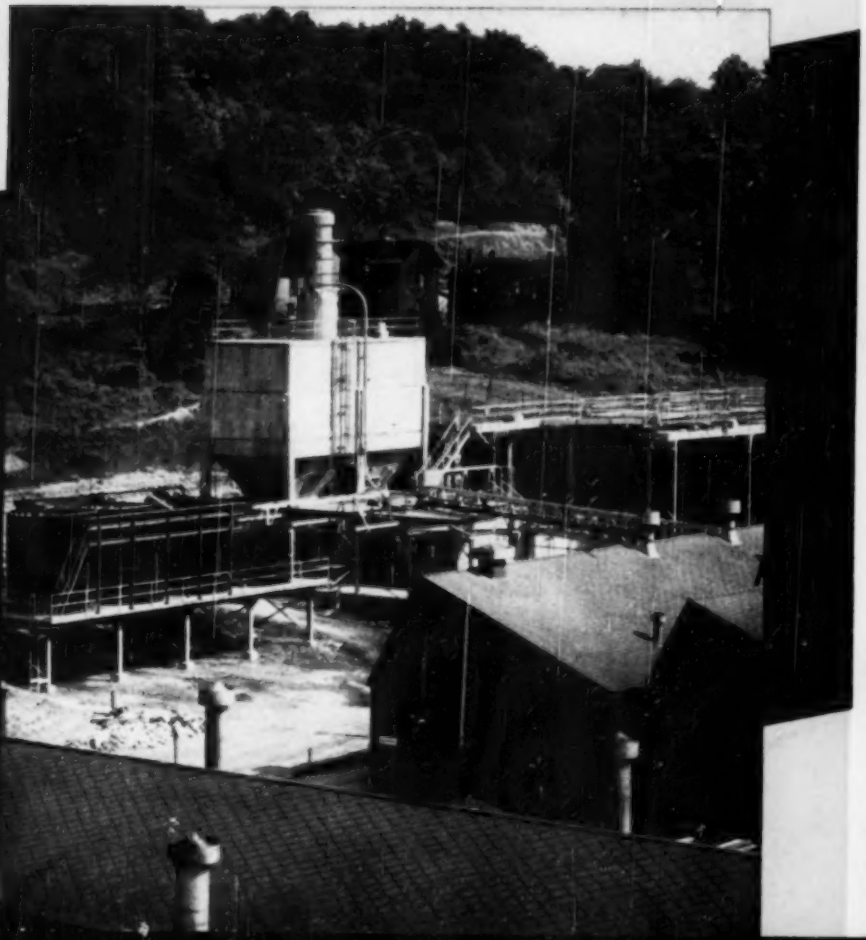
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# CHEMICAL ENGINEERING

with CHEMICAL & METALLURGICAL ENGINEERING

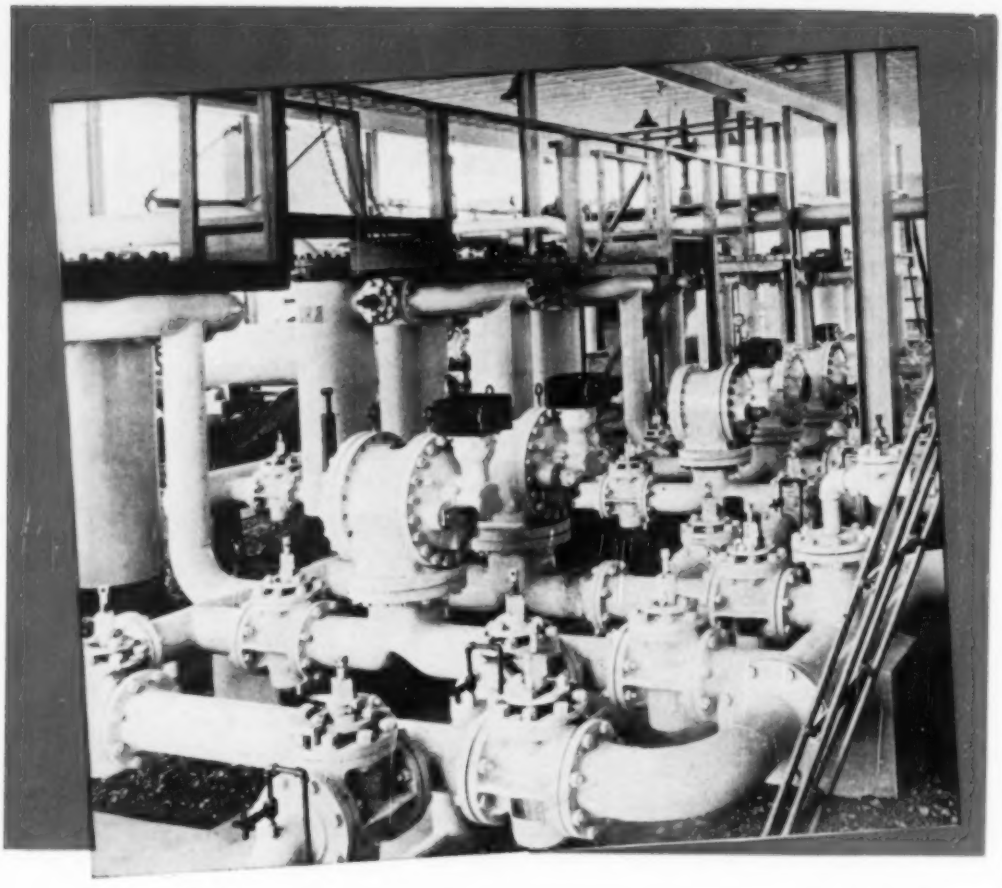


Chem. Eng.

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waste disposal, includ-
how to make a survey,
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ver picture: Cyanide and
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YOU can be sure of one thing about engineers who lay out product piping. They play safe! And there you have reason No. 1 for widespread use of the No. 1 brand of welding fittings by the petroleum industry.

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**WELDING FITTINGS AND FLANGES**



# CHEMICAL ENGINEERING

with CHEMICAL & METALLURGICAL ENGINEERING



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Volume 56 — March 1949 — Number 3


## REPORT ON WASTE DISPOSAL


Alpha and Omega—EDITORIAL FOREWORD . . . . . 95
Survey Your Problem—W. J. ELDRIDGE . . . . . 96
Ohio Valley Program Marks a Trend and Points a Moral . . . . . 99
Don't Throw Trouble to the Winds—V. L. KING & R. J. JENNY . . . . . 107
Dispose of Pickle Liquor at a Profit—HARRY KRAIKER, JR. . . . . 112
Atomic Wastes—ARTHUR E. GORMAN & W. A. RODGER . . . . . 116


## OTHER ARTICLES THIS MONTH


Federal Waste Law—EDITORIAL STAFF SUMMARY . . . . . 119
AEC Reports on its Progress . . . . . 120
Continuous Chrome Yellow Process—ROGER WILLIAMS, JR . . . . . 121
Commercial Chemical Development—HOYT M. CORLEY . . . . . 124
Ammonia: Anhydrous to Aqua—J. TIELROOY . . . . . 127
Economic Trouble Shooting—WILLIAM H. TELL . . . . . 129
Building Design for Batch Processes—HAROLD W. JOHNSON . . . . . 131
Steam Economies—H. L. THOMPSON . . . . . 136
Pickle Liquor Utilization—A CHEM. ENG. PICTURED FLOWSHEET . . . . . 144


## EVERY MONTH


| | | | |
|---|---|---|---|
| Book Reviews | 319 | Industrial Notes | 276 |
| Chementator | 71 | Manufacturers' Publications | 167 |
| Commodity Survey | 351 | Men, Machines and Methods | 187 |
| Convention Calendar | 196 | New Construction | 358 |
| Convention Papers | 286 | New Products | 171 |
| Correction | 222 | News | 193 |
| Corrosion Forum | 251 | Personals | 263 |
| Economics | 349 | Pictured Flowsheet | 144 |
| Editorials | 138 | Plant Notebook | 140 |
| Editorial Foreword | 95 | Price Trends | 352 |
| Equipment News | 151 | Production Data | 354 |
| Foreign Abstracts | 310 | Production Trends | 352 |
| Foreign News | 225 | Reader Service Coupons | 168 |
| Government Publications | 336 | Readers' Views and Comments | 214 |


An index to advertisers will be found on the fifth page preceding the back cover


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If your operating conditions demand a metal that will resist scaling and corrosion and maintain high mechanical strength at elevated temperatures, one of the four grades of HASTELLOY alloy may solve your problem. These alloys are available in all standard forms and can be readily fabricated by most common methods. For descriptive literature and price lists, contact our nearest district office.



PART: Cyaniding Basket
ALLOY: "HASTELLOY" A
BATH TEMPERATURE: 1550 deg. F.
COOLING: By dumping in water
LIFE: 3 years

PART: Cyaniding Rack
ALLOY: "HASTELLOY" A
BATH TEMPERATURE: 1625 deg. F.
COOLING: In oil
LIFE: 1 year



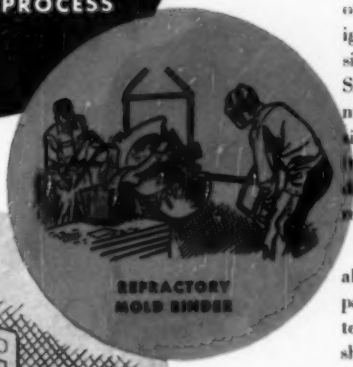
HAYNES TRADE-MARK alloys

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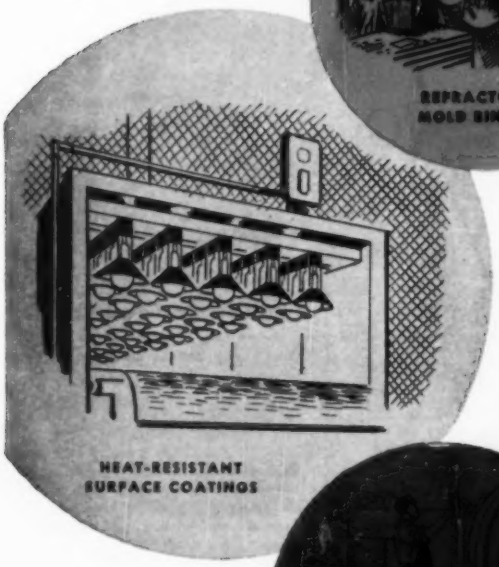
The trade-marks "Haynes" and "Hastelloy" distinguish products of Haynes Stellite Company.

# Condensed Ethyl Silicate

## A UNIFORM PRODUCT FROM A NEW PROCESS



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HEAT-RESISTANT SURFACE COATINGS



**You can now obtain uniform Condensed Ethyl Silicate in carload quantities. A new process assures a consistent product making it possible to standardize methods for depositing adhesive silica.**

Condensed Ethyl Silicate is a mild-odored, light yellow liquid consisting of 85 per cent by weight tetraethyl orthosilicate and 15 per cent polyethoxy siloxanes. It undergoes most reactions characteristic of the monomer, and on hydrolysis or ignition it yields a high purity, refractory silica. This improved Condensed Ethyl Silicate should be considered as an intermediate for the preparation of a variety of siloxane-containing molecules. For example, it can be copolymerized with many hydroxyl compounds to confer greater heat resistance.

For precision casting of high-melting alloys, Condensed Ethyl Silicate is unsurpassed as an investment binder. New techniques for non-solvent hydrolysis have sharply cut the cost of application. Paints that are extremely resistant to high temperatures and to most chemicals can be made using Condensed Ethyl Silicate as a binder for the pigments. Hydrolyzed solutions of Condensed Ethyl Silicate will harden the surface of architectural and artistic sandstones.

A high purity monomer, tetraethyl orthosilicate, also is available in commercial quantities.

*Write or phone any Carbide office for technical information on Condensed Ethyl Silicate.*

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# AO C1300 On-Center Metal Goggles

*They're Back Again Protecting Workers Comfortably!*



Again available... AO C1300 line of metal spectacle goggles provides peak protection against flying particles with the utmost in wearing ease.

SAFETY FEATURES include orbit-shaped, Super Armorplate lenses (or 6 Curve Super Armorplate lenses) scientifically hardened to resist impact... strong double-braced bridge ... close-to-face frame ... amply ventilated side shields for side protection where necessary.

COMFORT FEATURES include lightness of goggles on the nose... flexible, acetate rocking nose pads — large enough to distribute pressure over a wide area ... insulated temples which are heat resistant and perspiration proof ... a variety of goggle sizes for precise fitting of the individual worker. Your nearest AO Safety Representative can supply you.

## Recommended Uses

**Clear Lenses Without Side Shields.** For frontal protection on operations such as machine and hand tool work, chemical and physical lab. work.

**Clear Lenses With Side Shields.** For frontal and side protection on operations such as chipping, grinding, riveting, machine work, hand tool, spot welding and bottling operations.

**Calobar Lenses.** When above operations also involve danger from glare, heat, ultra-violet and infra-red radiations, Calobar lenses should be worn. Also recommended for welders' helpers (under helmet), workers near welding work, railroad men, truck drivers and helpers, bus drivers and others needing protection from wind, dust, cinders, flying particles and glare.

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$CH_3-(CH_2)_n-CH_3$

# NORMAL PARAFFINS

## OF HIGH PURITY

| TYPICAL ANALYSES | | | | |
|---|---|---|---|---|
| | $C_{12}$-$C_{20}$plus | $C_{12}$-$C_{14}$ | $C_{15}$-$C_{17}$ | $C_{18}$-$C_{20}$plus |
| Specific Grav. 20/4°C | 0.774 | 0.760 | 0.773 | 0.778 @ 35/4°C |
| Color, Saybolt | Water-white | Water-white | Water-white | Water-white |
| Melting Range, °F | 40-55 | 15-25 | 45-55 | 80-90 |
| Bromine No. | 0.1 | 0.1 | 0.2 | 0.1 |
| Dist.: IBP | 450 | 428 | 496 | 576 |
| FBP | 657 | 491 | 553 | 692 |
| n-Paraffins, vol. % | 95 plus | 95 plus | 95 plus | 95 plus |

● Normal paraffins ranging from $C_9$ to $C_{23}$ are now offered by Shell Chemical for your evaluation. These products vary in physical state from water-white liquids to low-melting point solids, and are essentially free of unsaturated hydrocarbons.

Sample quantities are now available in the ranges of $C_{12}$ to $C_{20}$, $C_{12}$ to $C_{14}$, $C_{15}$ to $C_{17}$, and $C_{18}$ to $C_{20}$.

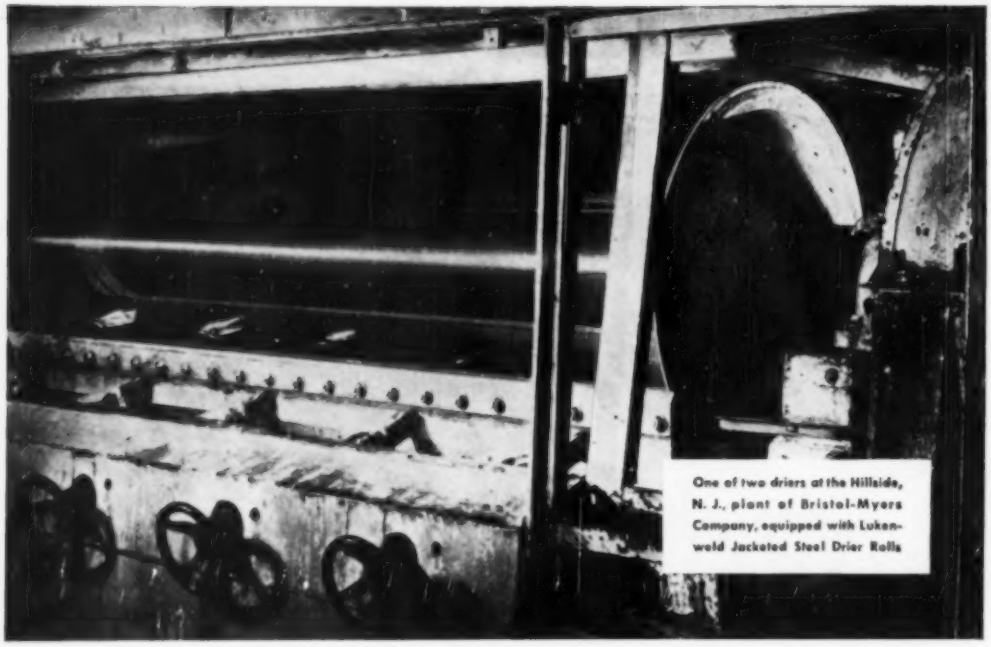
These normal paraffins are suggested as intermediates for the manufacture of detergents, plasticizers, halogenated hydrocarbons, and other products. *A letterhead request will bring samples and further technical information.*

● Among the many products marketed by Shell Chemical are Acrolein, Methyl Ethyl Ketone and Secondary Butyl Alcohol.

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One of two driers at the Hillside, N. J., plant of Bristol-Myers Company, equipped with Lukenweld Jacketed Steel Drier Rolls

# Bristol-Myers *Upped Production 41%* with Lukenweld Jacketed Drier Rolls

PATENTS APPLIED FOR

200 pounds of dried, flaked material every 7 to 8 minutes instead of the 10 to 11 minutes formerly required! That's how much Bristol-Myers stepped up output from these machines simply by replacing drum-type rolls of different material with Lukenweld Jacketed Steel Drier Rolls—an average increase of 41%.

No other changes were made. The increased production was entirely due to the increased drying rate and positive method of condensate removal of rolls of Lukenweld design and steel plate construction. Had steam pressure been increased above the 80 psi used in both old and new rolls, the drying rate could have been further increased.

Records since installation of the Lukenweld Rolls in 1938 show a further saving. Despite the action of a 30% saline solution, the steel plate roll faces, which are chromium-plated, have lasted over six years. In contrast, chromium-plated surfaces on the old style rolls had to be refinished every year and a half.

If you have a job calling for roll drying, you can probably do it better and faster with Lukenweld Jacketed Steel Drier Rolls. Bulletin 358 tells you about them. Lukenweld, Division of Lukens Steel Company, 400 Lukens Building, Coatesville, Pa.

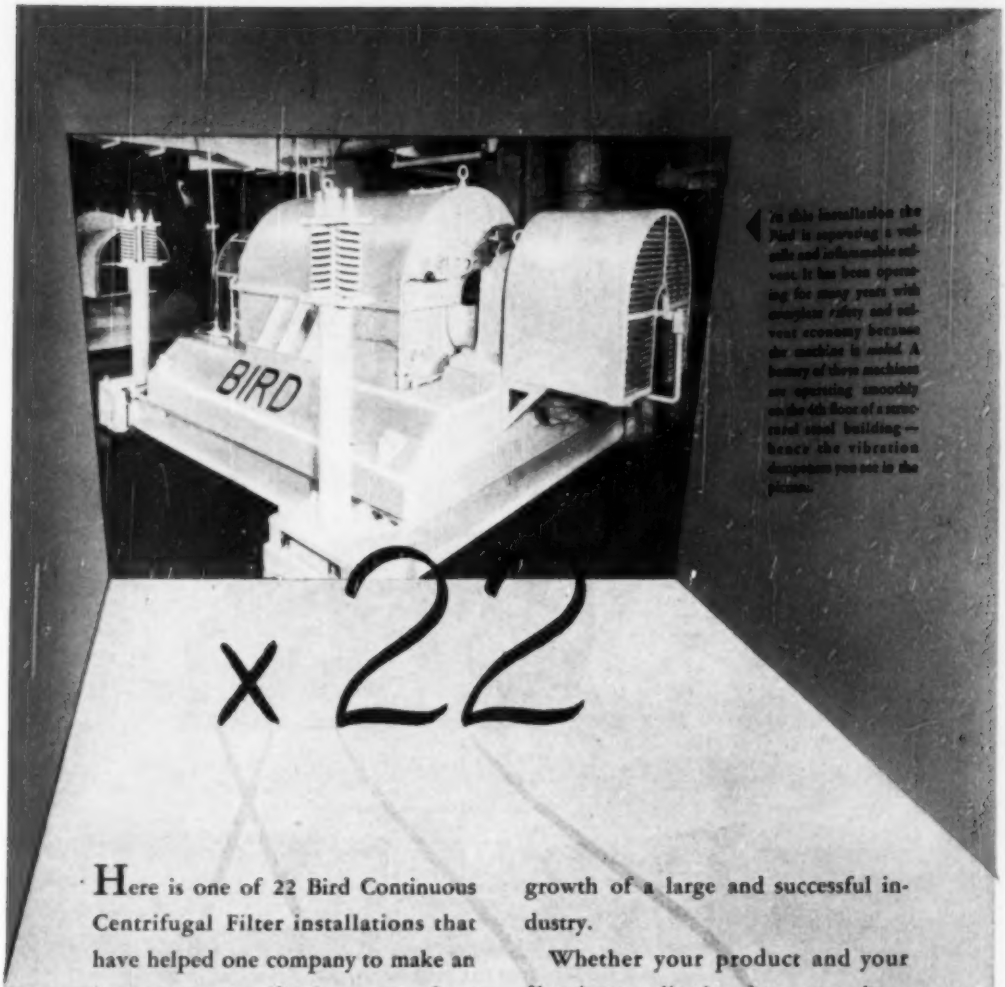
*We'll lend you "LUKENWELD", a 16mm motion picture with sound, highlighting our methods, facilities and products. Running time: 20 minutes. Write for booking date.*

LUKENS
LUKENWELD DIVISION

**LUKENWELD**

**DRIER ROLLS AND DRYING MACHINERY**

• • SPEED SCRAP TO THE MILLS TO MAKE MORE STEEL • •




At this installation the Bird is separating a volatile and inflammable solvent. It has been operating for many years with complete safety and solvent economy because the machine is sealed. A battery of three machines are operating smoothly on the 4th floor of a structural steel building — hence the vibration dampeners you see in the picture.

Here is one of 22 Bird Continuous Centrifugal Filter installations that have helped one company to make an important contribution to modern living at a cost within the reach of all.

Starting with a new product and one small pilot plant BIRD, the present large flock of BIRDs is given a substantial share of the credit for the growth of a large and successful industry.

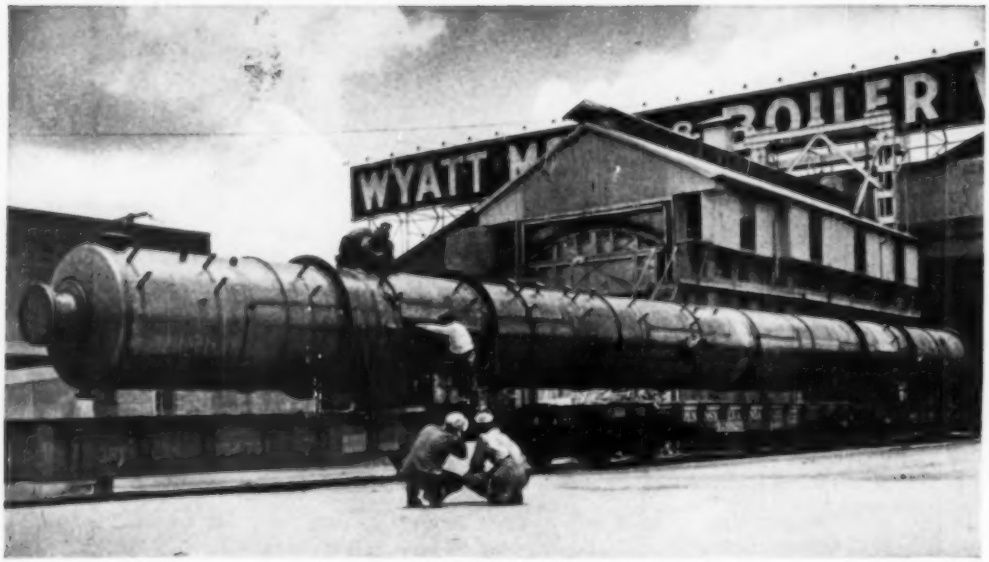
Whether your product and your filtration application is new or long familiar, results in case after case make it the better part of wisdom to get the answer to this question, "can I make a better product and more of it per day at lower cost with the Bird Filter?"

**BIRD MACHINE COMPANY**

SOUTH WALPOLE • MASSACHUSETTS

# For STRENGTH in FRACTIONATING COLUMNS

# HERCULOY




*Fractionating column, 108' 6" high, 78" I. D., fabricated out of Revere's Herculoy by the Wyatt Metal & Boiler Works, Houston, Texas.*

FRACTIONATING columns need strength, because of their height, and also because they often must resist considerable pressure. They also must be immune to attack by the fluids and vapors involved in the fractionating process.

Such specifications of the chemical industry spell Herculoy. This copper alloy is Revere's silicon bronze, a remarkable metal with the corrosion resistance of copper, and the strength of mild steel. Herculoy Alloy No. 420, for example, has a tensile strength of 94,000 psi, for sheet in hard temper, and 60,000 psi, soft. It can be readily welded by any of the commercial methods.

The illustration shows a giant column made of Herculoy by the Wyatt Metal & Boiler Works, Houston, Texas. Fabrication: welding by Heli-arc method, using Herculoy 420 welding rod. The column stands 108' 6" high, and the inside diameter is 78".

It is a pleasure to report that more and more Herculoy is being used by fabricators for the refining and chemical industries, not only for fractionating columns, but also for tanks, pressure vessels, and other applications in which strength and corrosion resistance are vital. The Revere Technical Advisory Service will gladly collaborate with you on Herculoy, which is made by Revere not only in sheet, strip and plate, but also in rod, wire, tube and forgings.

**REVERE**

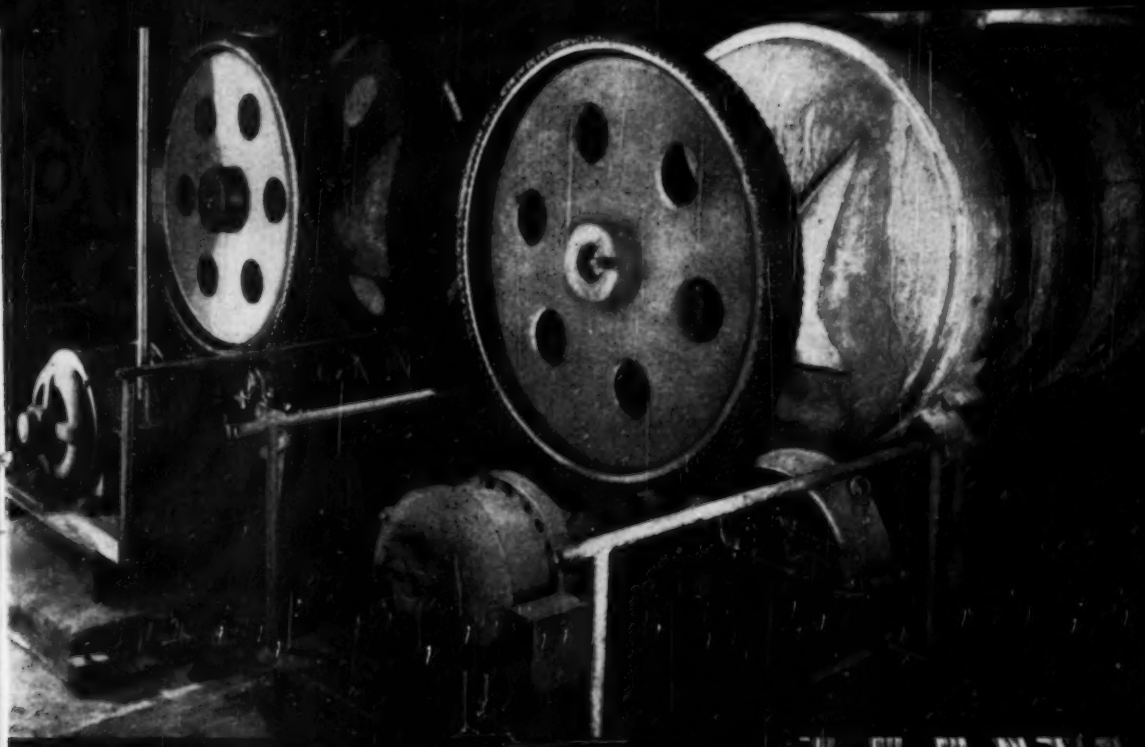
**COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*

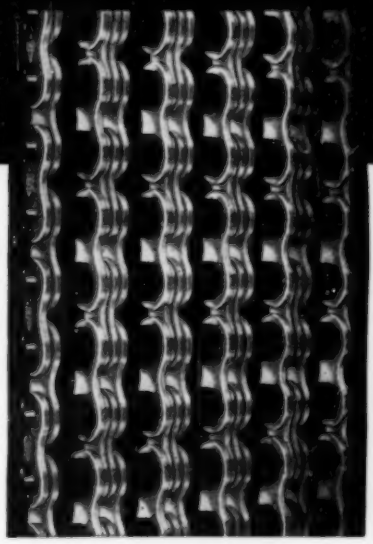
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# How LINK-BELT Roller Chain Drives *Stopped Costly Break-Downs*



## *—and helped tankage dryers do an outstanding job*

Production delays were ended and maintenance costs reduced when Link-Belt quintuple width roller chain drives and herringbone gear drives (furnished by Electrical Engineering & Equipment Co., Des Moines) were applied on several tankage dryers in an Iowa meat packing plant. Noisy, troublesome drive arrangements of bulky bull gears and spur pinions were eliminated — and with them, frequent repairs necessitated by broken gear teeth. The remodelled dryers now operate so efficiently that two others will soon get the Link-Belt "treatment".

Link-Belt roller chain, used here in combination with the Link-Belt speed reducer, provides a positive, non-slip drive. It delivers its full quota of power . . . takes up less space . . . operates silently . . . requires scarcely any maintenance. Extreme durability assures dependable, economical operation.

Link-Belt roller chains and sprockets are noted for their precision and long life. Link-Belt chain specialists can aid you in applying this flexible, positive, economical medium to your conveying and power transmission requirements.

**LINK-BELT COMPANY**

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# LINK-BELT

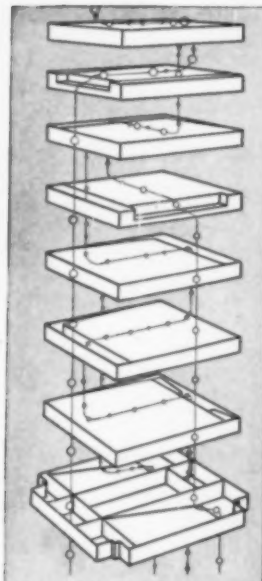
**Power Transmission Machinery**

**"THE COMPLETE LINE"**

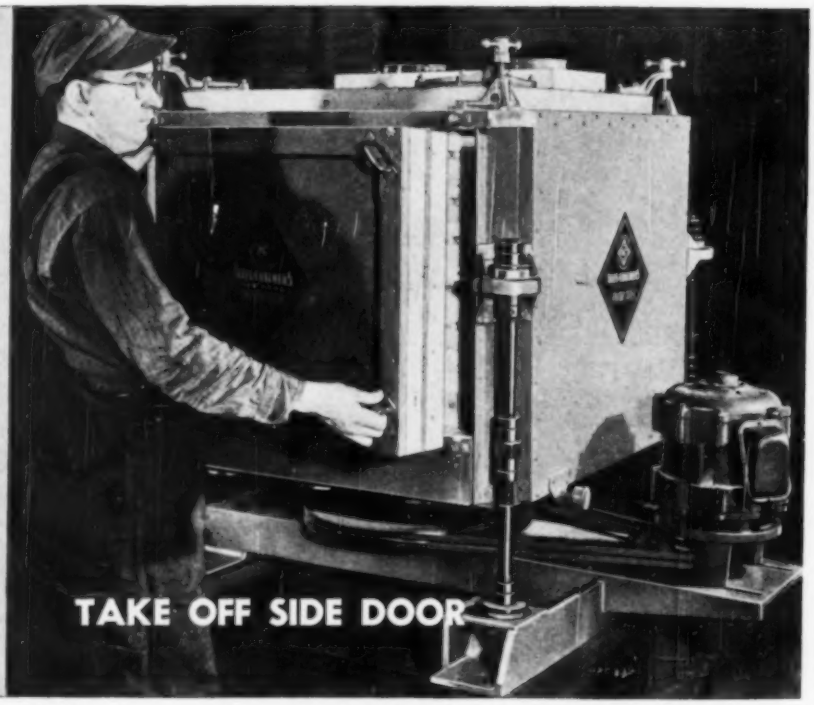
**TYPES OF LINK-BELT**
**Power Transmission Machinery**

- Silverlink Roller Chain
- Silverstreak Silent Chain
- Steel and Malleable Chain
- Worm Gear Drives
- Herringbone Gear Drives
- Helical Gear Drives
- Gearmotors
- PIV Gear Speed Changers
- Electrofluid Drives
- V-Belt Drives
- Ball Bearings
- Roller Bearings
- Babbitted Bearings
- Couplings, Clutches, Collars, etc.

# Solve Sifting ...THIS CONVENIENT,



Top two sieves separate largest particles of entering feed. "Throughs" continue over and through remaining sieves. Separated products discharged through bottom hopper.






NEW ALL-METAL LOW HEAD SIFTER — COMPACT AND DUST-TIGHT

## Now—Over 100 Chemical Products Accurately Graded With Low-Head Gyratory Sifter . . .

EASY TO SEE WHY this versatile sifting unit is being put to more and more uses in chemical processing! It has a bigger capacity, size for size, than any sifter on the market. It provides 2 to 8 separations . . . offers 2 to 200 mesh size range; 25 to 50 sq ft cloth area. It will grade a variety of chemical products to precise specifications and can handle two products at the same time, with divided sieve boxes.

You'll like the ease of cleaning and maintenance — side opening door makes it a simple matter to remove sieves. Just loosen four door and cover bolts and remove tension rod. Take off side door and remove sieves, which can be cleaned in a jiffy.

It's a money-saver, too! Costs only a few cents a day to operate. There's no deadweight. Sifter rides on eight non-lubricated flexible cushions which eliminate destructive vi-

# Problems

## LOW-COST WAY!




bration. Sifter, motor, drive, and base are all one unit, built and supplied by one company.

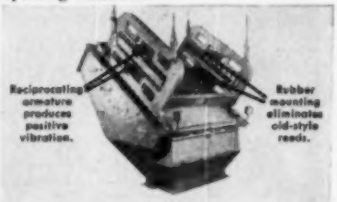
*Low-Head sifters* are available in all-metal construction for high temperature products and abrasive or corrosive materials. More than 100 different products are processed through *Low-Head sifters* in industrial applications. These include chemicals, plastics, ceramics, rubber, foods, and minerals. There is an Allis-Chalmers representative near you. Call him. Or write for Low-Head Sifter **Bulletin B6124A.**

ALLIS-CHALMERS, 1147A SO. 70 ST.
MILWAUKEE, WIS.

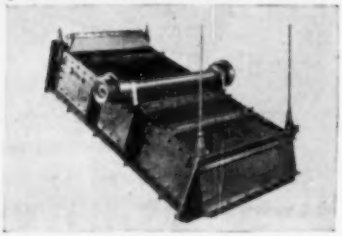
## ALLIS-CHALMERS BUILDS OTHER EQUIPMENT FOR SIEVING, SCREENING . . .



**SQUARE SIFTER** can handle large quantities of a wide range of materials; 2 to 200 mesh size range; up to 433 sq.ft.cloth area. New, streamlined Allis-Chalmers unit is fully suspended from ceiling with four sets of reeds. Speed and throw can be adjusted easily to obtain best operating conditions.




**ELECTRIC SCREENS** *Utah* electric totally-enclosed screens operate on electro-magnetic principle for fine wet or dry screening with minimum blinding. Any granular material from 10 to 48 mesh (dry) or 65 mesh (wet) can be properly sized. Finger-tip control of vibration. Many applications. **Bulletin 07B7044.**



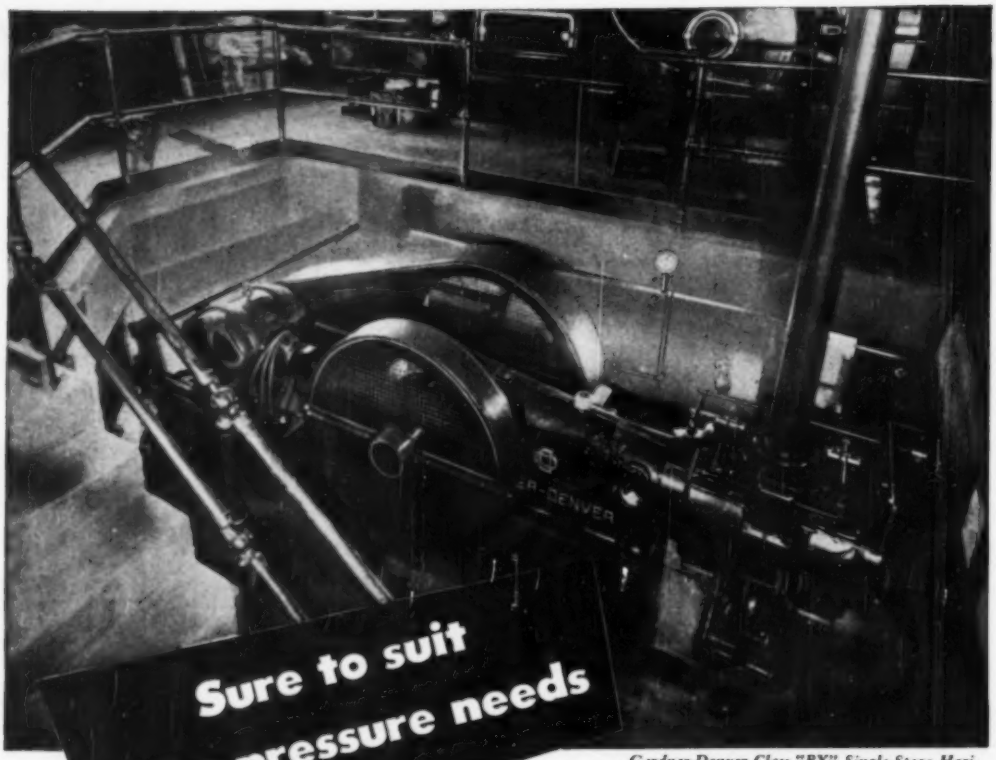
**AERO-VIBE SCREENS** An inclined type medium duty vibrating screen. Can be used for handling hot materials 175 to 450° F. Water cooled bearings can be furnished for high temperature applications. Available with stainless steel construction for corrosive materials. Open or totally enclosed types. **Bulletin 07B6099.**

*Low-Head* and *Aero-Vibe* are Allis-Chalmers trademarks.

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# ALLIS-CHALMERS

**One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products**




*Gardner-Denver Class "RX" Single-Stage Horizontal Compressor—available in capacities from 89 to 1292 cubic feet displacement per minute.*

Whether you need air at the usual shop pressures . . . or considerably below . . . there's a Gardner-Denver "RX" Compressor just right for your job. Available in a wide range of sizes, these compressors are famous for a variety of heavy-duty, full-load services. Volumetric efficiencies rate high — power costs unusually low. At the right are other reasons why you find the "RX" in so many different industries.

For complete information, write Gardner-Denver Company, Quincy, Illinois.

★ Complete water jacketing of cylinder, heads, and air passages assures low discharge temperature.

★ Suction valve unloaders on all inlet valves result in lowest power consumption during unloaded period.

★ Gardner-Denver Duo-Plate "Cushioned" Valves—simple, durable, quiet.

★ Large, unrestricted port areas help reduce heat of compression; insure effective lubrication with minimum oil consumption.

★ Streamlined, enclosed main frame completely oil and dust tight—yet all working parts are easily accessible.

★ Timken adjustable double-row tapered roller bearings support crankshaft.

**GARDNER-DENVER** **SINCE 1859**

# ALOYCO GATE VALVES

## *earned* leadership the hard way

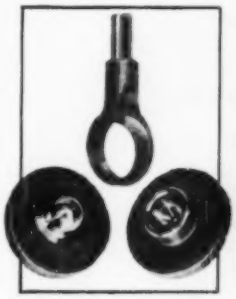
Some manufacturers *earn* leadership—some just *claim* it. ALOYCO GATE VALVES have gained and held their leadership by toil and sweat, mixed with hard thinking, on the problems of corrosive-fluid pipe lines, exclusively.

This leadership has been earned by sound, service-proven design . . . by foundry craftsmanship that produces uniformly dependable castings . . . by seasoned experience in the selection of the optimum alloy for specified corrosive conditions . . by skilled machine shop practice that insures utmost mechanical efficiency in the finished valve.

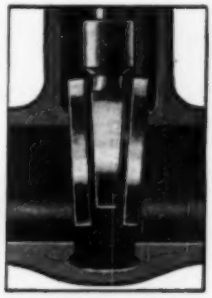
You *can* have the best. Why run the risk of costly replacement tie-ups with anything less?



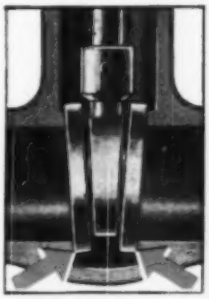

*This is the No. 111, 150 lb. ALOYCO GATE VALVE, flanged, F and D. Sizes ½" to 12". Available in 18-8S, 18-8SMo, Aloyco 20 and other corrosion-resistant alloys.*



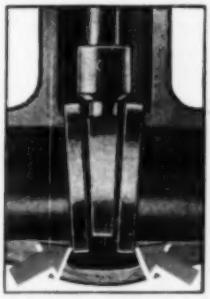
Completely fool-proof parts.



Floating discs can rotate, for even wear on the parts.



Direct acting—stem thrust through wedge rings seats the parts.



Double valve protection—complete shut-off at two points.

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ASK STOKES

# Dry in SECONDS with Stokes Drum Dryers

TEN seconds more or less . . . 10 degrees higher or lower . . . are often the difference between success and failure in a chemical drying process.

The continuous drying of slurries and solutions of heat-sensitive materials is often feasible and profitable only when accomplished in *seconds* . . . and there is no better way to dry many such materials than by drum drying.

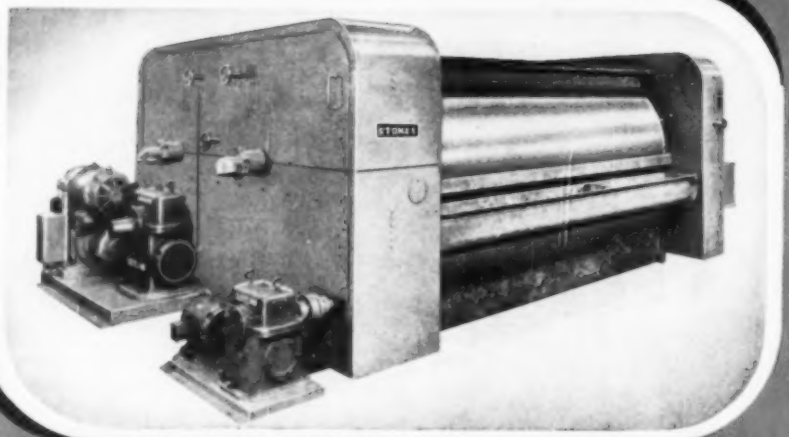
Stokes drum dryers are "application-designed" to fit the precise needs of your product. Moisture content, consistency, heat sensitivity, required production rate, and all other factors are carefully analyzed before a recommendation is made.

. . . and you can test the procedure in the Stokes semi-plant-scale laboratory.

If you have any problem in drying, it may be worth while to let Stokes work with you.

F. J. Stokes Machine Company,
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*Stokes makes Vacuum and Special Processing equipment, High Vacuum Pumps and Gages, Pharmaceutical equipment, Industrial Tabletting and Powder Metal Presses, Plastics Molding Presses, Water Stills and Special Machinery.*




This double drum unit is one of many sizes and types of drum dryers built by Stokes for the processing industries.

STOKES KNOWS HOW

# WOLVERINE SEAMLESS NON-FERROUS




**Quality controlled from ore to finished product**

***Available in all standard sizes from ⅜" to 2" O.D.***

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**"85-15" BRASS ALLOY**

**ALUMINUM BRASS**

**CUPRO-NICKEL, "30%"**

**CUPRO-NICKEL, "10%"**

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**WOLVERINE TUBE DIVISION**

CALUMET AND HECLA CONSOLIDATED COPPER COMPANY
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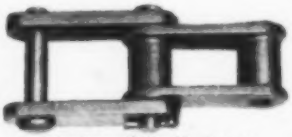
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Combination—Malleable Iron or SUPERMAL Block Links and Steel side bars.



"H" Type Mill—Malleable Iron, SUPERMAL or PERDURO



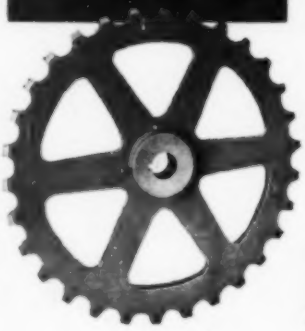
"400" Class Pintle



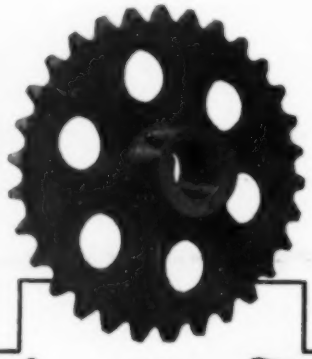
Malleable Roller—Malleable Iron, SUPERMAL or PERDURO



Steel Thimble Roller with straight or offset side bars



**For every Elevating, Conveying and Driving need. Easy to select the right type and size from the broad Jeffrey line.**





Long Pitch Steel Thimble Roller with plain or flanged rollers



"800" Class Steel Bushed



Steel Knuckle



Transfer



Steel Block in various types



"H" Type Refuse—Malleable Iron or SUPERMAL



A-1



F-2



H-2



K-2



A-42 with C-wing



G-6



S-1

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# U.S.I. CHEMICAL NEWS

March ★ A Monthly Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1949

## New Products Developed By Agricultural Research

Recent research to develop new industrial products from agricultural raw materials and farm wastes has resulted in a number of improved products and processes. Among these is a "partial acetylation" process for making cotton virtually rotproof and mildewproof. Another new textile process produces an "aminized" cotton which, unlike ordinary cotton, is said to take acid wool dyes well and to be capable of further modification for superior water repellency.

An improved method of solvent extraction of cottonseed reportedly requires only one solvent, and gives superior products — including a new material, cottonseed pigment glands, with possible uses as antioxidants and plasticizers. An outstanding new synthetic rubber, derived from milk sugar and manufactured now by a continuous process, is described as superior in heat resistance to natural rubber, and to all other synthetic rubbers except silicones.

Improved processes for the extraction of rutin from buckwheat plants have stimulated interest in new uses for it. The fact that rutin protects dogs from harmful effects of midlethal doses of X-rays suggests it may be a valuable prophylactic against injury from atomic radiation. Rutin is also said to prevent gangrene in cases of frostbite.

## *Radiant Energy Is Used In Fractional Distillation*

For separating fractions made up of two compounds of nearly the same boiling points or constant boiling mixtures, a new simple process making use of radiant energy is described in a recent patent. The process can be carried out, the patent states, right in the top of the regular fractionation column during normal fractional distillation procedure. The new method reportedly takes advantage of the well known principle that compounds having the same vapor pressure differ in their absorption of radiant energy. In the new process radiant energy is used to maintain one of the compounds in its original state while the second is separated by a change of state, according to the patent. This method is said to require no addition or subsequent recovery of azeotrope-forming agents, solvent extraction agents, or chemical reaction agents.

## Radioactive Cobalt Used In Treatment of Cancer

Radioactive cobalt, described as a suitable substitute for radium in treatment of ailments such as skin cancer, will be available within a year in amounts equivalent to many pounds of radium, according to a scientist's report. The first applications of radio-cobalt are expected to be in the form of cobalt bombs, similar to radium bombs but far less costly. It is anticipated that other radioactive substances being produced now by atomic piles will be useful in the diagnosis of various types of cancer.

# 'Pyrenone' Insecticide Wipes Out Warehouse Infestation Overnight

### Non-Toxic Pyrenone Emulsion Proves Highly Effective Against Grain-Destroying Insects, Other Food Pests

**Achieving a spectacular overnight cleanup of a heavy insect infestation in a large flour warehouse, U.S.I. "Pyrenones" recently demonstrated their outstanding effectiveness against all types of grain-destroying insects. A combination of piperonyl butoxide with pyrethrum extracts, Pyrenones are a superior contact insecticide providing long-lasting residual protection.**

#### Overnight Treatment Gives Complete Control

When local health department inspectors conducting a routine inspection found large numbers of insects crawling on flour bags in the warehouse, they placed "Retained" tags on all the flour and gave the management five days in which to clean up the infestation. A specialist was called in to spray the flour storage area.

Overnight, forty gallons of Pyrenone emulsion (containing just ten gallons of emulsifiable Pyrenone) were sprayed to cover the 100,000 cubic feet of warehouse. Rate of application was about 3 ml. per square foot. On the following day health inspectors returned and carefully examined the flour and storage areas. They were able to find only three or four flour beetles still alive — these in a moribund condition and dead the next day. The spraying had been so completely effective that all the flour was immediately released.

Thousands of dead insects of all types were found on the floor and in the cracks between the floors and walls. Confused flour beetles predominated in number. In addition, however, cadelles, several species of weevils, grain beetles, grain borers, moths and yellow meal worms — both larvae and adults — were present in quantity.

Had fumigation been undertaken, the cost would have been more than twice that for spraying, and the warehouse would have had

MORE

## *New Clinical Use Is Found for Methionine*

The antidicoumarol action of DL-methionine was demonstrated in medical experiments conducted recently. The tendency to lowering of prothrombin activity in rabbits after administration of dicoumarol was said to be decreased after preliminary oral administration of methionine. This antidicoumarol action is expected to prove helpful in the clinical use of dicoumarol, since control will be more readily achieved.

## Transparent Plastic Bag Makes Good Dust Mask

Protection of workers from dust in certain industrial processes has been achieved, it is claimed, by the use of transparent plastic bags worn as a head covering. Powder-free air is supplied by hose from a small compressor, it is reported. Positive pressure within the bag is said to prevent any dust from rising against the escaping air. The lightweight device gives no sense of being enclosed and powder does not easily adhere to the surface of the filmy bag, the users state.



**Application of Pyrenone Emulsifiable Concentrate to skids and floor of a storage warehouse. A single spray treatment wiped out the infestation and provided good residual protection.**

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March ★ **U.S.I. CHEMICAL NEWS** ★ 1949

## *Thirty Tons of Spinach*

Two years work on thirty tons of spinach are said to have been required for the isolation of a thousandth of an ounce of the vitamin folic acid. This amount is described as just about enough for curing one case of sprue, a deficiency disease similar to pernicious anemia.

## CONTINUED Warehouse Infestation

to close completely for at least twenty-four hours. Application of the spray, on the other hand, was carried out overnight; approximately three-and-one-half weeks later the warehouse was examined and no living insects were found.



**Grain insects like the one in the center of this photograph—a Cadelle larva—quickly succumb to the insecticidal action of non-toxic Pyrenones.**

### Safe Insect Control with Pyrenones

Ingestion by the insect is not necessary for the action of Pyrenones to take effect—the insecticide kills by contact or by absorption. Insects commonly affecting the food industries, particularly cockroaches, are not repelled by it. Toxicology of Pyrenone concentrates has been studied with an unusual degree of thoroughness, and results of a series of acute oral experiments on laboratory animals, extending over two years fully justify the conclusion that the concentrates contribute no toxicological hazards.

The effectiveness of these safe, non-toxic Pyrenones in food plant sanitation leaves little to be desired. Properly compounded and applied, they control not only all types of grain-destroying insects, but also flies, mosquitoes, roaches, ants, and other customary pests, and are unusually effective, too, against the mites and skippers which trouble meat packers and cheese plant operators.

## Develops New Improved Distillation Packing

A new type distillation packing, claimed to be more efficient than any other packing except Stedman packing, has been developed. Said to be automatically self-wetting, so that no preflooding is required, the packing permits attainment of equilibrium very rapidly, it is reported.

The packing is produced by perforating more than one thousand holes per square inch in thin metal sheets, which are shaped into half cylinders with corners or edges bent in to avoid stacking. The holes are not clean cut, since burrs on one side reportedly permit easy wetting of the packing by liquids. Packing is installed, it is claimed, by simply pouring it through a funnel into the column.

## *Thermoplastic Films Are Now Welded at High Speed*

Electrostatic welding of organic thermoplastic films can now be carried out at high speed, according to a patent published recently. The welding apparatus is said to have a grounded fixed electrode which presents a smooth surface to the film and which is maintained at a fixed temperature below the heat distortion temperature of the film. A second, movable electrode, connected electrically to a high frequency source, presses the lapped films as they are advanced between it and the fixed electrode.

## TECHNICAL DEVELOPMENTS

*Further information regarding the manufacturers of these items may be obtained by writing U.S.I.*

**A new flowsheet template** with a manual of standard symbols is said to assist in making piping and process diagrams and flowsheets. Symbols include valves of all common types, instruments, pumps, fans, blowers, ejectors and a number of heat exchangers, the makers state. **(No. 425)**

**A new fast setting adhesive for wood,** claimed to provide an unusually strong, moisture-resistant, resilient bond with a transparent glue line, is said to be ready to use without cooking, heating, or mixing. **(No. 426)**

**"News in print"** is the manufacturers' description of a new fluorescent silk-screen printing ink, said to make signs readable at about four times the distance window posters are ordinarily seen. **(No. 427)**

**A specific for ammoniacal urine and diaper rash in babies,** said to clear these conditions in three to five days by making use internally of nutritional substances, is on the market. **(No. 428)**

**For preventing and treating motion sickness** in automobiles, trains, and ships, a new drug, said to have no undesirable side effects, is available. **(No. 429)**

**A harmless but powerful spray deodorizer,** claimed to destroy odors within 10 to 15 seconds after release in a room as an aerosol mist, is odorless, non-staining, and non-irritating, the makers state. **(No. 430)**

**To apply standard pressure tape to drums,** roll goods, cannisters, and cartons on a production basis, a new semi-automatic machine takes packages up to 17 inches in diameter, the manufacturers assert. **(No. 431)**

**A new peelable plastic packaging material,** claimed to protect metal items from corrosion and abrasion, is said to be transparent fire resistant, and reclaimable for reuse. **(No. 432)**

**Nitrogen 15 is reported available** in the form of nitric acid or potassium nitrate for research in agricultural chemistry, explosives, and organic syntheses. **(No. 433)**

**A glass vacuum adapter** for fractional distillation is said to be simpler, surer, and more economical than multiple stopcock types. **(No. 434)**

**Labels are applied rapidly** to wood, steel, corrugated board, glass, or tin containers, regardless of size, shape, or type, it is claimed, with the aid of a new machine and special label paper. **(No. 435)**


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Completely Denatured—all regular and anhydrous formulas
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Dibutyl Oxalate
Diethyl Oxalate

**PHTHALIC ESTERS**
Diamyl Phthalate
Dibutyl Phthalate
Diethyl Phthalate

**OTHER ESTERS**
*Diatol
Diethyl Carbonate
Ethyl Chloroformate

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Acetoacet-ortho anisidide
Acetoacet-ortho-chloroanilide
Acetoacet-ortho-toluidide
Acetoacet-para-chloroanilide
Ethyl Acetoacetate
Ethyl Benzoylacetate
Ethyl Sodiumoxalacetate

**ETHERS**
Ethyl Ether
Ethyl Ether Absolute—A.C.S.

**FEED CONCENTRATES**
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*Curbay B.G. *Special Liquid Curbay

**ACETONE**
Chemically Pure

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*Aroplaz—alkyds and allied materials
*Arofene—pure phenolics
*Arochem—modified types
Ester Gums—all types
Congo Gums—raw, fused & esterified
Natural Resins—all standard grades

**INSECTICIDE MATERIALS**
*Pyrenone Concentrates
Pyrethrum Products
Rotenone Products

**INSECTIFUGE MATERIALS**
*Indalone
*Dimetone
Triple-Mix Repellents

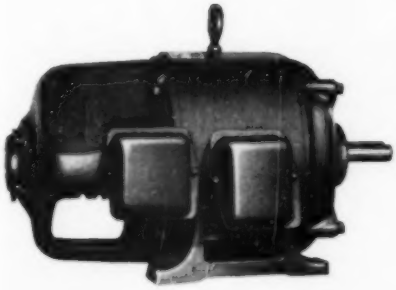
**OTHER PRODUCTS**
Collodions Urethan, U.S.P.
Nitrocellulose Solutions DL-Methionine
Ethylene

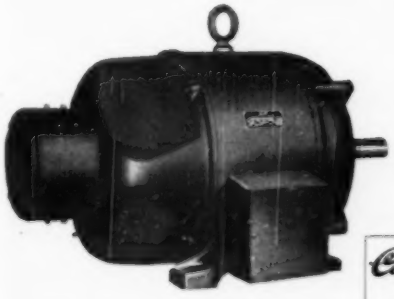
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# There is a Century Motor

## for Any Application that Will Provide Top Performance, Unusually Quiet Operation







The wide range of types, kinds and sizes of Century motors enables you to specify motors with the right characteristics to meet all popular electric power requirements.

Century builds, among others, a complete line of 3 phase squirrel cage motors, Type SC from 1/6 to 400 horsepower.

- **Type SC** motors provide normal starting torque at normal starting current. They are suitable for all general purpose applications—or about 80% of the jobs.
- **Type SCH** motors provide high starting torque with low starting current. These motors handle hard-to-start loads without over-motoring. Typical examples are reciprocating compressors and pumps starting under full load
- **Type SCT** motors combine high starting torque with high slip. They are suitable for equipment having high peak and high impact loads—such as oil well pumps, punch presses.
- **Type SCX** motors in larger sizes develop low starting torque with low starting current for applications that are very easy to start and start infrequently—such as large centrifugal pumps and fans.

In addition to these standard variations of the Type SC motors, Century offers

- **Type SR,** Slip Ring motors with high starting torque, adjustable variable speed control. Typical applications include reciprocating pumps, conveyors, elevators, cranes and hoists.
- **Type SY,** Synchronous motors for continuous operation as a power factor load correction, such as for large ventilating fans and electric generators.

Century builds a complete line of electric motors, in a wide range of types and kinds, in sizes from 1/6 to 400 horsepower. They are available in open drip proof, splash proof, totally enclosed fan cooled or explosion proof frames—and for horizontal, vertical or flange mounting.

Specify Century motors for all your electric power requirements.

Popular types and standard ratings are generally available from factory and branch office stocks.

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# Spray Drying

## is the answer to many process problems

*As research* progresses at the Swenson Spray Dryer Laboratory, numerous advantages of the process become apparent in an increasing variety of uses.

**ECONOMY**

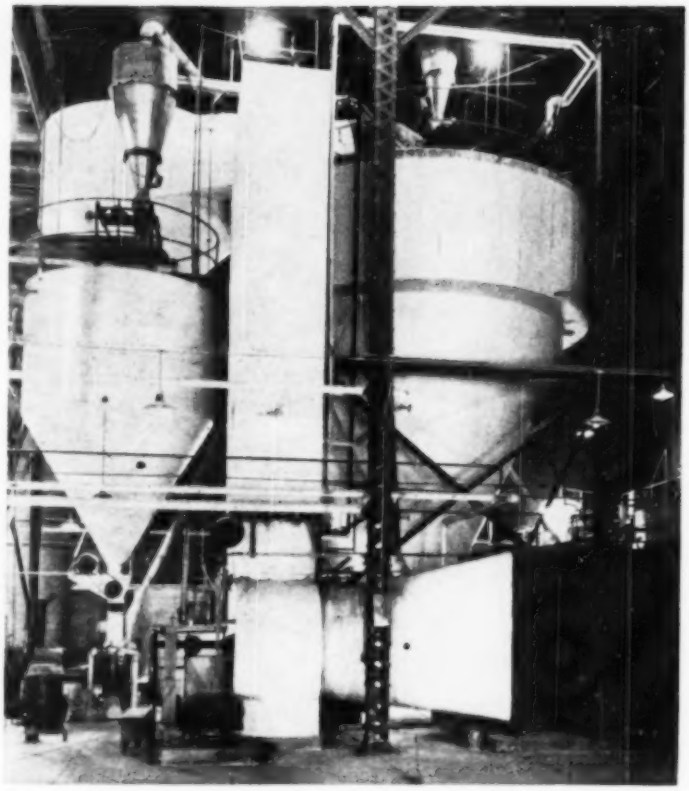
Spray drying converts liquids to solids in a single pass...in some cases eliminating the necessity of evaporating, crystallizing, filtering, tray drying, and other intermediate processing. The product is a dry powder which requires no milling or grinding, thus saving extra equipment and reducing labor costs.

**CONTINUOUS**

Spray drying is inherently a continuous process, and in many instances it successfully replaces slower and more expensive batch methods.

**CONTROL**

Through instrumentation, the temperature is controlled to obtain optimum conditions. This enables spray drying to be used for heat-sensitive materials, and for various other substances which cannot be sucessfully processed by other means.



***Have You a Drying Problem? . . . Consult Swenson***



**SWENSON EVAPORATOR CO.**
**DIVISION OF WHITING CORPORATION**
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# Solvent . . . Versatile Intermediate . . . Heat Transfer Fluid

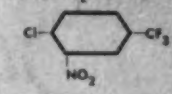
## All These in *HOOKER MONOCHLOROBENZENE*

Hooker Monochlorobenzene is serving chemists in many different ways:

1. As a good general solvent, it is especially helpful in the manufacture of paints, varnishes, lacquers and their removers.
2. As an insecticidal intermediate, it is used in the preparation of DDT and other insecticides.
3. As a dyestuff intermediate, it is used in the preparation of sulfur black and brown dyes.
4. As a chemical intermediate, it is used in the manufacture of many organic synthetics, such as picric acid, phenol, dinitrochlorobenzene, drugs and perfumes.
5. As a heat transfer fluid—for condensing vapor systems where glass enameled jackets cannot stand high steam pressure, monochlorobenzene can be used in the range from its boiling point (130° C) up to about 190° C.

Hooker Monochlorobenzene is a clear colorless liquid of high purity. It is a carefully distilled material and after drying with calcium chloride, will distill within 1°C. For more complete physical and chemical information send on your business letterhead for Technical Data Sheet No. 703B.

**HOOKER RESEARCH PRESENTS**
**3-NITRO-4-CHLOROBENZOTRIFLUORIDE**
**$C_6H_3CF_3[3\text{-}NO_2,4\text{-}Cl]$**




| | |
|---|---|
| Molecular Weight | 225.56 |
| Freezing Point | −7.5°C |
| Boiling Point | 222°C |
| Specific Gravity 15.5°/15.5°C | 1.542 |
| Refractive Index n20/D | 1.491 |

To its growing list of organic fluorides, Hooker now adds 3-Nitro-4-chlorobenzotrifluoride. It is a thin yellow oily liquid. Indications are that 3-Nitro-4-chlorobenzotrifluoride is a valuable addition to the group of chemical intermediates. It is subject to further ring substitution in the number 5 position. The nitro group may be reduced in alkaline media. The chlorine atom is very stable and unlike other benzotrifluoride compounds, hydrolysis results in attack on the $CF_3$ group.

Patent literature discloses a variety of applications for nitrochlorobenzotrifluoride in the preparation of azo dyestuffs and pharmaceuticals. At present available in pilot plant quantities, production in commercial quantities can be quickly undertaken when circumstances warrant. Hooker Technical Data Sheet, gives more complete physical and chemical characteristics and literature references. When writing for literature or samples please use your company letterhead.

OTHER HOOKER CHLORO-BENZENES

- Hexachlorobenzene
- Orthodichlorobenzene
- Paradichlorobenzene
- 1,2,4,5-Tetrachlorobenzene
- 1,2,4-Trichlorobenzene

*From the Salt of the Earth*

**HOOKER ELECTROCHEMICAL COMPANY**

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and other
Processing Industries

**RAYON CONSULTANTS, Inc., an American engineering firm specializing in the synthetic fiber industries, designed, process-engineered and supervised the erection of this $17,000,000 plant, which appears to be destined to become a powerful factor in the world rayon industry.**

Compania Rayonera Cubana, world's newest and most versatile rayon plant, is now in operation at Matanzas, Cuba. It is the only major plant producing textile, tire and staple rayons under one roof — with a combined capacity of 13 million pounds of filament and fabric per year.

Its rapid completion during times of postwar stringencies was a triumph of alert and forceful management — application of the best engineering brains to the tremendous problems of location, design and construction.

The latest, most advanced ideas in design and equipment, developed in recent years by the rayon industry, were incorporated at Matanzas. The old "cut and try" method of rayon plant design has given way to orderly application of sound engineering principles. For example, the Matanzas plant can be doubled in size with a minimum of rearrangement of present facilities and at minimum expense.

*RAYON CONSULTANTS
INCORPORATED
75 MAIDEN LANE
NEW YORK 7, N.Y.

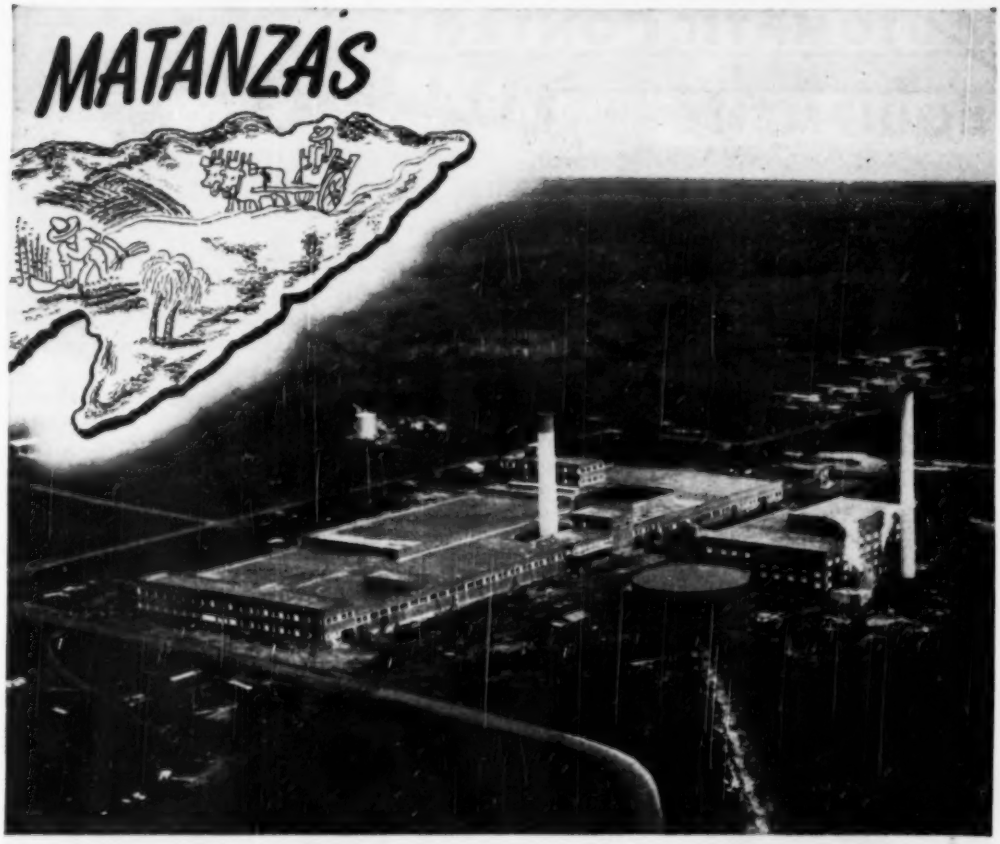
Only in the hands of a sound, skilled and experienced engineering organization could this modern industrial construction have been accomplished.

O. G. KELLEY & COMPANY was specified to supply and install all lead work and Stainless Steel Equipment at Compania Rayonera Cubana, S. A.

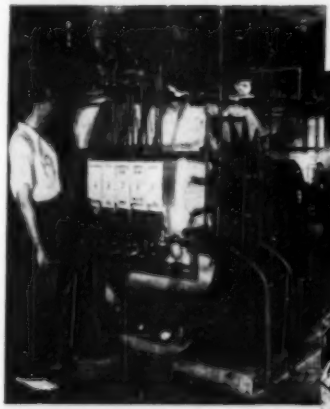
KELLEY
LEAD
STAINLESS
STEEL
Fabrication

O. G. KELLEY & COMPANY
94 TAYLOR STREET, BOSTON 22, MASS.
NEW YORK, N.Y. JOHNSON CITY, TENN. ELIZABETH, N.J.

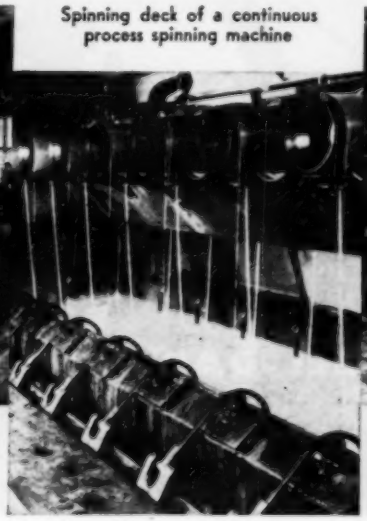
*Stainless Steel Equipment — Custom Built for the Chemical and Processing Industries*




General aerial view of Compania Rayonera Cubana, Matanzas, Cuba.



A wet churn unit for the xanthation step in viscose production.



Spinning deck of a continuous process spinning machine



Staple-spinning: Lead-sheathed stretch rolls and acid cutters.

# AUTOMATIC CONTROL EQUIPMENT

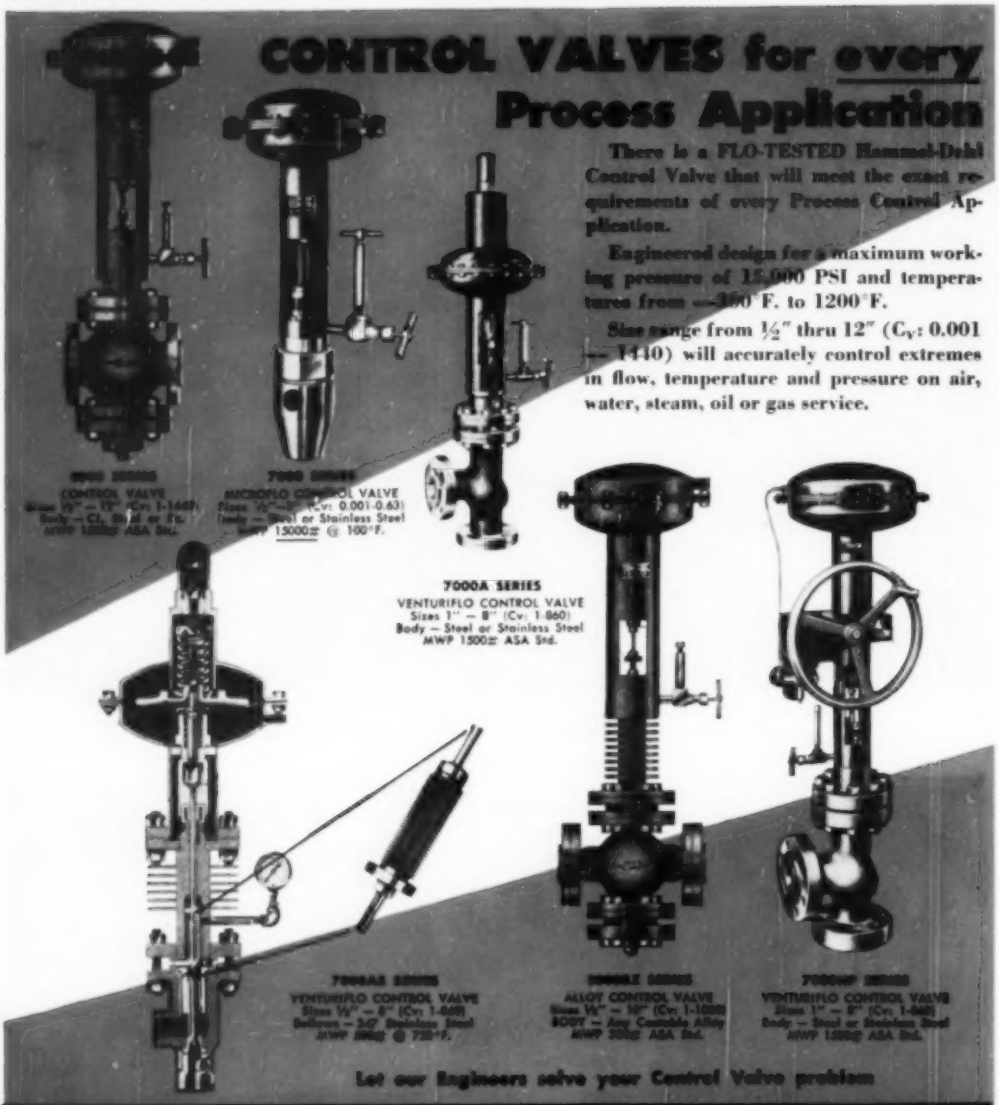
ENGINEERED DESIGN BY **HAMMEL-DAHL**

## CONTROL VALVES for every Process Application

There is a FLO-TESTED Hammel-Dahl Control Valve that will meet the exact requirements of every Process Control Application.

Engineered design for a maximum working pressure of 15,000 PSI and temperatures from —300° F. to 1200° F.

Size range from ½" thru 12" ($C_V$: 0.001 — 1440) will accurately control extremes in flow, temperature and pressure on air, water, steam, oil or gas service.



7000A SERIES
VENTURIFLO CONTROL VALVE
Sizes 1" — 8" (Cv: 1.860)
Body — Steel or Stainless Steel
MWP 1500# ASA Std.

Let our Engineers solve your Control Valve problem

**HAMMEL-DAHL COMPANY**

243 RICHMOND STREET, PROVIDENCE 3, R. I., U.S.A.

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SEATTLE ST. LOUIS SYRACUSE TOLEDO TULSA WILMINGTON, DEL.

*In Canada, Railway & Power Engineering Corporation, Ltd.*




# Here's the answer to your rust prevention problems

THE BOOKLET illustrated above holds the means to more complete and more economical rust control in your plant. It will help you analyze your rust prevention problems and needs. It tells how the new, improved Stanorusts now fully meet these needs.

The eight grades of Stanorust are described. They range from a fingerprint remover to a heavy, petrolatum-type product that protects against corrosion under the most severe outdoor exposure for years.

Find out why Stanorusts can mean big savings for you through better rust protection. Send for this booklet. Write for your copy today. Simply address your letter to Standard Oil Company (Ind.), 910 S. Michigan Ave., Chicago 80, Ill.

**Send for a copy**

**STANDARD OIL COMPANY (INDIANA)** STANDARD

# Research at work TO BRING YOU MORE



A Westinghouse Research Engineer studies arc phenomena with a Spectroscope. Constant fundamental research and experimental activities such as these, combined with the work of specialized engineers, turned a scientific discovery into an important practical advance in power conversion—the modern Ignitron Mercury Arc Rectifier.




## HOW WESTINGHOUSE RESEARCH BENEFITS THE CHEMICAL INDUSTRY

Westinghouse Research has contributed—or aided in the development of—many achievements important to the chemical and electrochemical field. These include:

- Ignitron Rectifiers
- Series Resonant Furnace Circuits
- Completely Protected Transformers
- Corrosion-resistant Switchgear

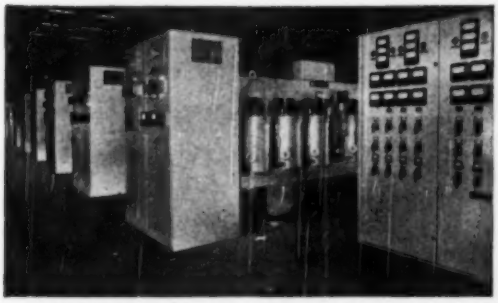
**WESTINGHOUSE ELECTRIC CORPORATION**
P. O. Box 868 Pittsburgh 30, Pa.

# PRODUCTIVE POWER

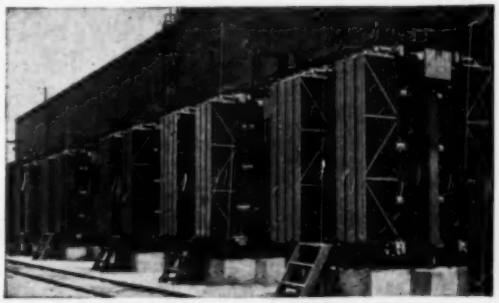
## WESTINGHOUSE RESEARCH HAS ONE GOAL: TO HELP YOU PRODUCE FASTER, CHEAPER, BETTER, ELECTRICALLY

New ideas, new processes, new materials for making electrical power more productive, flow steadily from the famous Westinghouse Research Laboratories. Many of these developments are at work now in *your* industry. War-born developments—in electricity, in electronics, in processing—promise many new advancements to help you produce *faster, cheaper, better,* electrically.

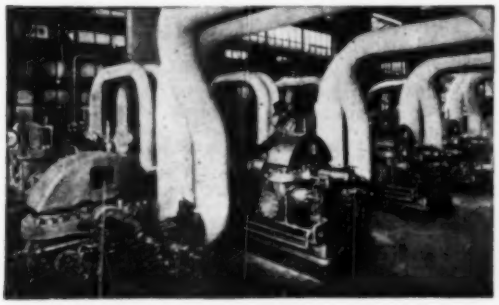
This broad basic research is an important added value to consider when you buy electrical equipment. A separate Westinghouse Industry Department, staffed by engineers intimately acquainted with chemical industry problems, assures the prompt and *practical* application of new Westinghouse research developments to your special production techniques. Here are typical examples: J-94739



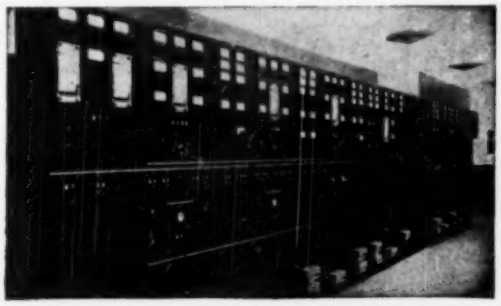
**HIGH-EFFICIENCY POWER CONVERSION**—Westinghouse Ignitron Rectifiers—a development from a discovery in pure science—fill a major need in the electrochemical field. They provide large blocks of rectified power for loads that must be carried continuously at full capacity—with no rotating parts to wear. For more information, ask for bulletin B-3024.



**HIGH-SAFETY POWER TRANSFORMATION**—Westinghouse Research produced the first commercial power transformer—today it maintains the lead in developments that add safety and efficiency. Hipersil steel—with 1/3 greater flux-carrying capacity—is an example. "Form-fit" tank design is another.



**HIGH-RELIABILITY STEAM POWER**—Multi-stage turbines like these furnish drive-power economically—as a by-product of the steam required for process. They represent the ultimate in performance and dependability for their applications and meet the exacting requirements of the chemical industry.



**SWITCHBOARD**—For complete plant switching, relaying and control. Provides a complete check on all the electrical equipment in the plant—from incoming line to distribution channels.




**Westinghouse**

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



**MORE PRODUCTIVE POWER FOR INDUSTRY**

# ANNOUNCING...




## WITH EASY-TO-CLEAN MAGNESIUM SIEVES

# Available Now For Prompt Delivery!

HERE's a new machine with specific advantages for the chemical processing industry. It's the Low-Head *all-metal* gyratory sifter — made of steel and lightweight magnesium.

This compact all-metal sifter will efficiently handle numerous materials — ranging from pure chemical products (such as barium nitrate) to impure metallurgical products (such as zinc concentrate).

*High-temperature* materials can be sifted — since this machine has no wooden parts. And *cleaning* is a simple matter—because the entire unit can be easily and safely *washed*.

The sifter is a high-speed, high-capacity unit holding four to seven sieves. It is patterned after the standard Allis-Chalmers gyratory sifter used by food and chemical processors all over the country. Sieve screens can be silk or metal — available in a variety of fine, medium and coarse meshes.

The Low-Head all-metal gyratory sifter is available *now!* Get full details from any A-C sales office or write direct, using handy coupon.

Low-Head is an Allis-Chalmers trademark.

**ALLIS-CHALMERS**

**Chemical Milling and Processing Equipment**

ALLIS-CHALMERS, 1147A SO. 70 ST A 2619
MILWAUKEE, WIS.

☐ Please send handy packet with information on new All-Metal sifter and standard sifter bulletin 06B6124A.

☐ Would like personal visit from A-C representative with details of new sifter.

Name

Company

Street

City State

| | | |
|---|---|---|
| **TIMKEN 18-8 STEEL TUBES** Shows the best combination of creep strength, oil corrosion resistance and oxidation resistance up to 1500°F. | **TIMKEN SICROMO 9 M STEEL TUBES** This steel possesses the maximum corrosion resistance of any of the steels below the stainless group. | **TIMKEN SICROMO 7 STEEL TUBES** For applications requiring better corrosion resistance than can be obtained with 5% Chromium type steels. |
| **TIMKEN SICROMO 5 S STEEL TUBES** For oxidation resistance to 1500°F. Good creep strength and corrosion resistance to 1300°F. | **TIMKEN 4-6% CR MO STEEL TUBES** For service up to 1200°F. Superior corrosion resistance. Less oxidation resistance than Sicromo 3. | **TIMKEN SICROMO 3 STEEL TUBES** For service up to 1200°F. Have excellent oxidation resistance and good corrosion resistance. |
| **TIMKEN 2¼% CR-1.0% MO STEEL TUBES** For service up to 1150°F. Has greater resistance to creep than 2% Cr. ½% Mo. Steel. | **TIMKEN SICROMO 2 STEEL TUBES** For service up to 1200°F., where better scale resistance is required than can be obtained with 2% Cr. ½% Mo. Steel. | **TIMKEN 2% CR ½% MO STEEL TUBES** For service up to 1150°F. Intermediate corrosion resistance plus good creep strength, fair oxidation resistance. |
| **TIMKEN DM STEEL TUBES** For service up to 1150°F. This steel offers outstanding creep strength. | **TIMKEN CARBON-MO STEEL TUBES** For temperature up to 1000°F. Improved creep strength makes it safer than carbon steel. | **TIMKEN CARBON STEEL TUBES** Generally for service not exceeding 900°F., where corrosion and oxidation resistance are not important. |

# Which one of these high temperature tubes has the LIFE/COST ratio that meets your needs?

OF these twelve Timken® tubes, developed to combat various conditions of heat, pressure, corrosion and oxidation, only *one* has the necessary properties to give you the best life/cost ratio for a particular application.

Our Technical Staff is prepared to select the correct analysis to meet your particular needs and to give you maximum life per dollar invested.

Metallurgists of the Timken Company are recognized authorities in high temperature applications—with 19 years of experience and research. In addition, they have a wide selection of Timken fine alloy steels from which to choose the best for the job.

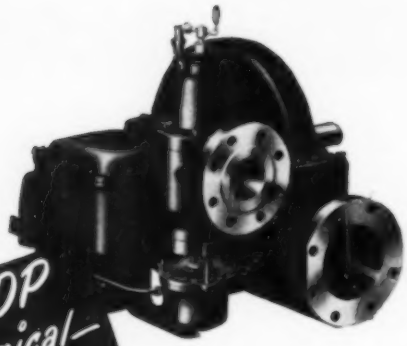
Whichever analysis is selected, you can be sure of uniform quality in every shipment, because the Timken Company maintains close quality control from melt shop to final inspection.

For qualified help in selecting the high temperature tubes that will give you the most for your money, call in our Technical Staff. There is no obligation, of course. For further information on our fine alloy steels and mill facilities, write for our free booklet, "Facilities and Products". The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

**YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH**




*Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.*



Type DP Mechanical-Drive Turbine

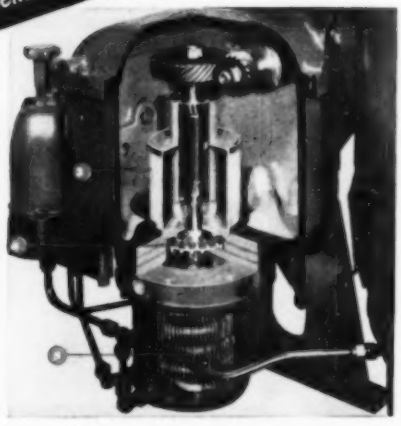
# LOOK AT THESE

## Better Governing



1. **30% ADJUSTABLE SPEED RANGE** is wider than obtainable with mechanical governors.
2. **RELIABILITY** even after long standby assured by totally enclosed, continuously lubricated hydraulic governor.

## Better Lubrication



3. **CLEAN OIL** maintained by bronze mesh oil strainer.
4. **POSITIVE PRESSURE** furnished by turbine-type oil pump.
5. **ADEQUATE OIL COOLING** provided by high-capacity fin-tube oil cooler.

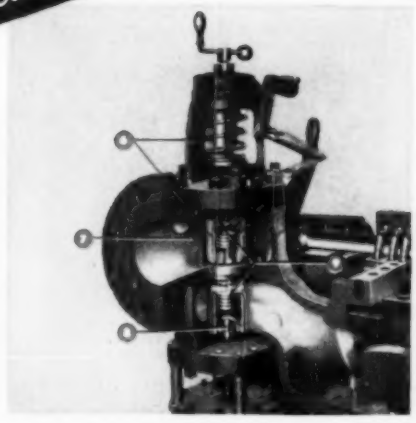
# SPECIAL FEATURES

## —AT NO EXTRA COST

YOU get a host of special features in the Type DP line of mechanical-drive turbines—features which provide better governing, lubrication, valving, and less maintenance than previous standard units. These features, formerly obtainable only on costlier "special" machines, are standard on the DP—at no extra cost.

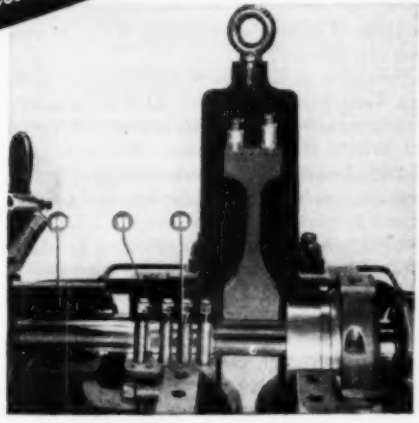
If you have a turbine application, be sure to investigate the time and trouble-saving features of the DP. Your G-E representative will be glad to give you all the facts. Apparatus Department, General Electric Company, Schenectady 5, New York.

*Better Valving*



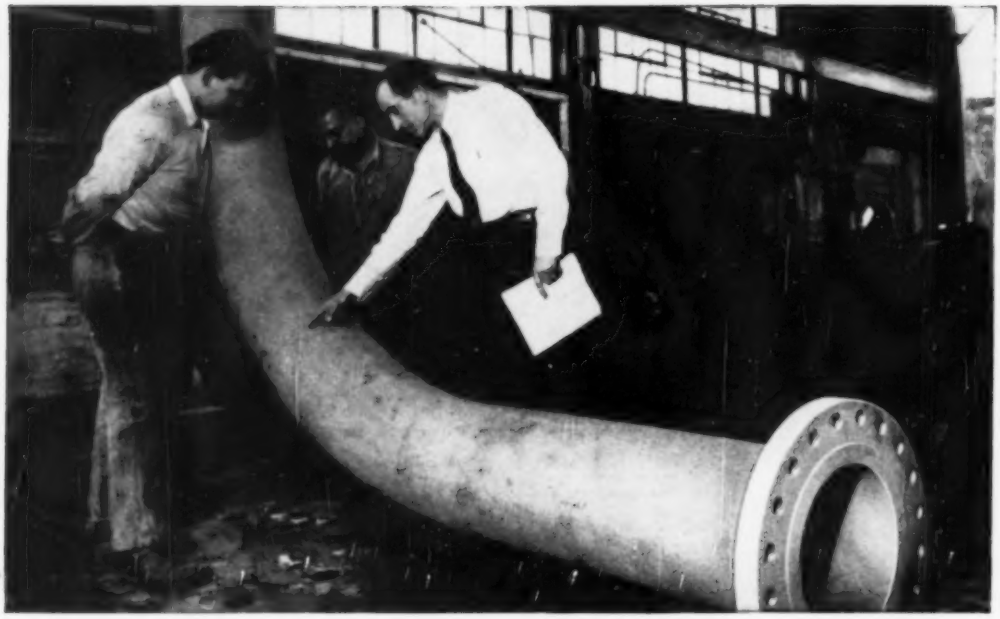
6. **COST OF SEPARATE SHUT-OFF VALVE** often saved by combined trip-throttle valve.
7. **LONG LASTING** heavy Monel steam strainer.
8. **MAINTENANCE REDUCED** by valve stem sealing bushings —no soft packings required.
9. **EASY ONE-HAND OPERATION** with balanced valve design.

*Less Maintenance*



10. **LONG BEARING LIFE** assured by solid-backed bearings.
11. **SHAFT EROSION PREVENTED** by Monel spray under packings.
12. **STEAM LEAKAGE** sealed off by heavy double-seal carbon packings.

GENERAL ELECTRIC



# ALLOY PIPING can be burned, too

A piece of burned alloy piping is just as useless as a burned roast.

Excessive grain growth, heat shock, cracking, local wall thinning, or local deformation, and excessive surface oxidation are some of the harmful results of improper heating of alloy piping. Procedures that are scientifically correct . . . careful control of furnace and fuel . . . sound judgment and experience . . . all are needed to avoid improper heating.

Qualified Fabricators work alloy pipe continuously and in quantity. Volume operations enable them to afford the laboratory and shop equipment . . . the scientific control . . . the skilled personnel to do a better alloy piping job . . . not only in heating but all along the line.

It will pay you well to get in touch with a Qualified Fabricator when you need piping.



**THE PIPE FABRICATION INSTITUTE**

*Devoted to the Technical and Economic Problems in Piping*

1108 CLARK BUILDING, PITTSBURGH, PA.

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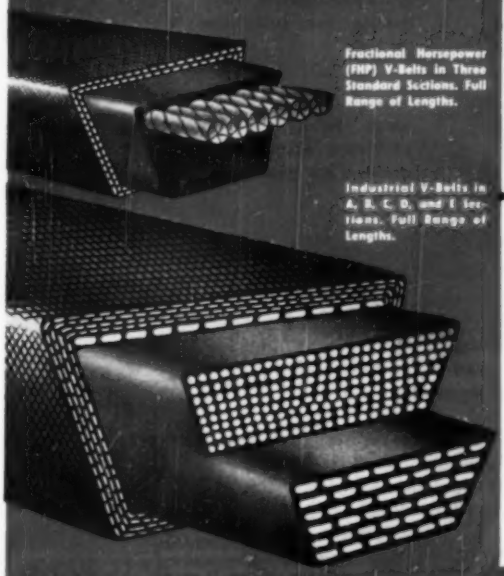




What Engineers ask about

# *New* BULL DOG V-BELTS

for use in the chemical industry



Fractional Horsepower (FHP) V-Belts in Three Standard Sections. Full Range of Lengths.

Industrial V-Belts in A, B, C, D, and E Sections. Full Range of Lengths.

BWH

DEPENDABLE RUGGEDNESS

**why** do new BULL DOG V-BELTS have less slippage?

Exclusive BULL DOG CORDS are processed in a new way, which results in amazingly low stretch. As a result, there's less slippage, fewer adjustments, longer belt life.

**why** do new BULL DOG V-BELTS carry heavy power loads for longer periods?

Exclusive BULL DOG CORD SECTION has higher tensile strength. This enables Bull Dog V-Belts to absorb the shock of sudden starts and stops, to run smoothly months on end.

**why** do new BULL DOG V-BELTS run cool and resist flexing?

BWH laboratories developed new quality-controlled compounds for Bull Dog V-Belts. Tests prove they run cool, don't crack or deteriorate under severe flexing.

**why** do we say new BULL DOG V-BELTS have proved their dependability?

Like all BWH products, Bull Dog V-Belts are put through the stiffest laboratory tests. But that's only the beginning! For ten years they've been given field tests under terrific hazards. Their performance proves they've got the stuff it takes for steady, trouble-free power transmission. And since their introduction in 1948, leading industries everywhere have found this newest addition to the famous BWH line fully upholds the BWH reputation for products of dependable ruggedness.

Another Quality Product of

**BOSTON WOVEN HOSE & RUBBER COMPANY**

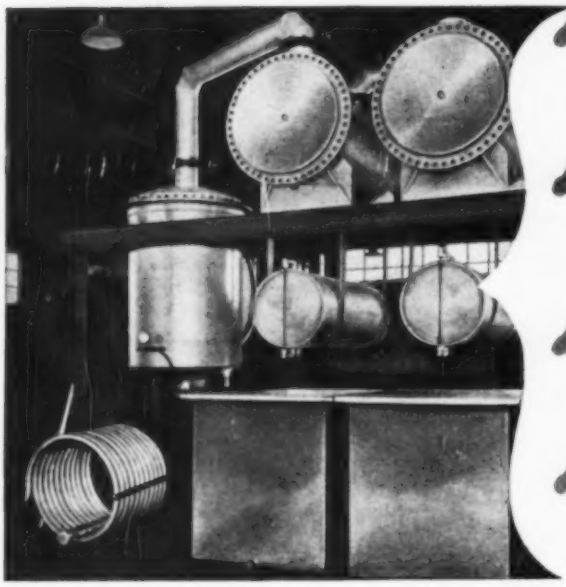
Distributors in all principal cities

PLANT: CAMBRIDGE, MASS., U. S. A. • P. O. BOX 1071, BOSTON 3, MASS.

# TAKE THESE 4 STEPS...

## *then design in Alcoa Aluminum*

**TO IMPROVE PRODUCTS . . . CUT COSTS . . . INCREASE YIELD**



Ask Alcoa for test data and design manuals to help you engineer the plans and designs.



Let Alcoa furnish you with test specimens and sample containers made of Alcoa Aluminum Alloys most likely to succeed in your process.



Call on Alcoa engineers, use their experience to guide your choice of alloys, designs, and fabrication methods.



Let Alcoa engineers assist you in designing pilot-plant equipment to double-check your conclusions.



This 4-way engineering help from design to successful pilot operation is the kind of help you get when you deal with Alcoa.

Alcoa Aluminum equipment maintains the quality and color of many foods, drugs, and chemicals; permits closer control of processes.

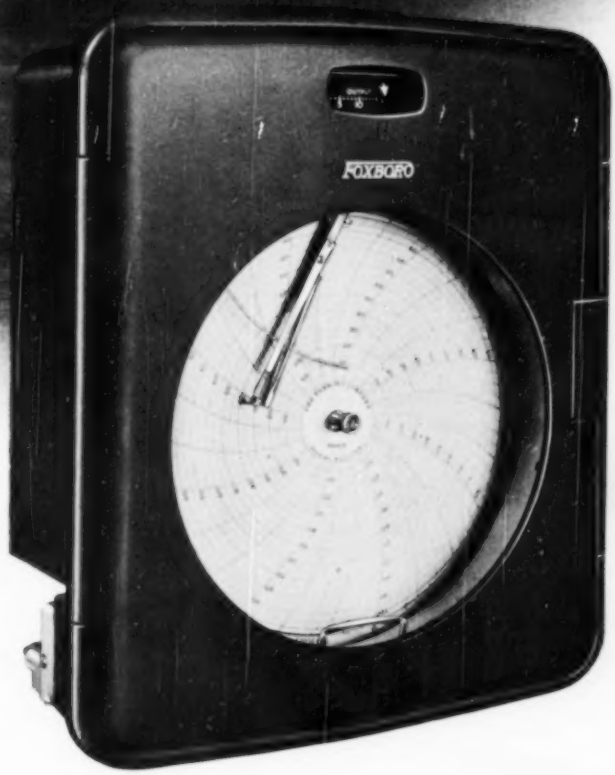
Aluminum alloys are available to withstand the stresses, pressures, and loads; are light to speed fabrication and erection; are readily formed and joined by all standard methods.

Tell us what chemicals or foods or drugs you want to process . . . we'll tell you what Alcoa Aluminum Alloys will probably work best, and how to design with them. ALUMINUM COMPANY OF AMERICA, 2151 Gulf Building, Pittsburgh 19, Pennsylvania. Sales offices in 55 leading cities.

**ALCOA** FIRST IN ALUMINUM

ALCOA

# AN "EYE-OPENER" IN
# Advanced Engineering




**EVERY KNOWN REQUIREMENT** of leading industries, every proved scientific advance in pneumatic control, every advantage of unmatched research and experience has guided the design of this truly modern controller. The results are simpler and more rugged construction, easier and permanently stable adjustments, unequalled performance.

Some M-40 parts such as the ball-pivot link and reset resistance are basically new. The entire mechanism presents a new criterion of simplicity and strength. Parts are made to machine tool precision and permanently aligned. Everything about the M-40 reflects advanced engineering, from its smoothly contoured front surface to its foolproof unit construction.

Such advanced engineering assures a long and profitable service life . . . another reason why more than 15,000 Model 40 Controllers have been purchased in the past 2 years.

FOXBORO REG. U. S. PAT. OFF. *M-40*

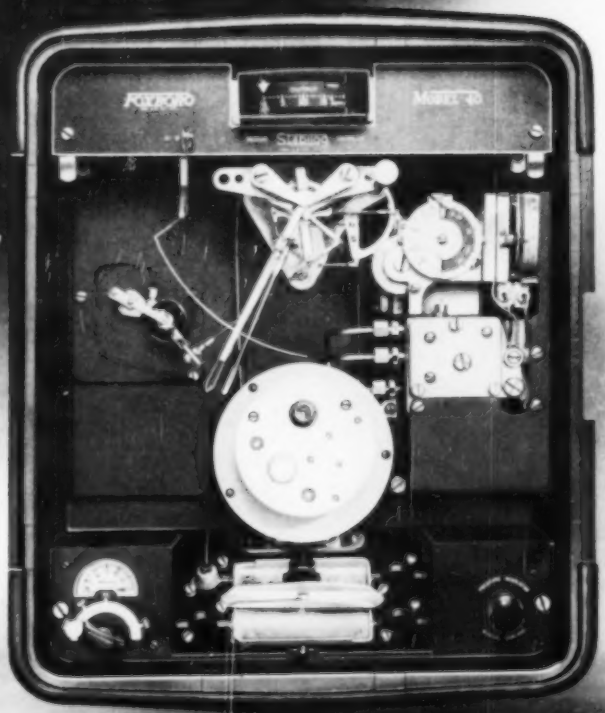
***"THE FINEST MODERN CONTROLLER"***

AN "EYE-OPENER" IN RESET ACTION

# Radically New Conception of

# WIDE RANGE RESET RESISTANCE





Wide-range, stepless, variable reset resistance is obtained without the use of needle valves or lengths of capillary tubing. No possibility of plugging . . . no critical setting to obtain precision adjustments. Movement of the setting lever changes flexure of a simple Bourdon Tube, varying its cross sectional area through a range of 500 to 1, permitting correct reset adjustment for any process. The reset scale, graduated in time-constant units, is logarithmic . . . therefore retains uniform sensitivity of setting over its entire range.

Hyper-Reset derivative action makes use of matched resistances placed side by side and calibrated so that optimum process control is obtained when both adjusting levers have the same setting. Both adjustments are reduced to a single operation!

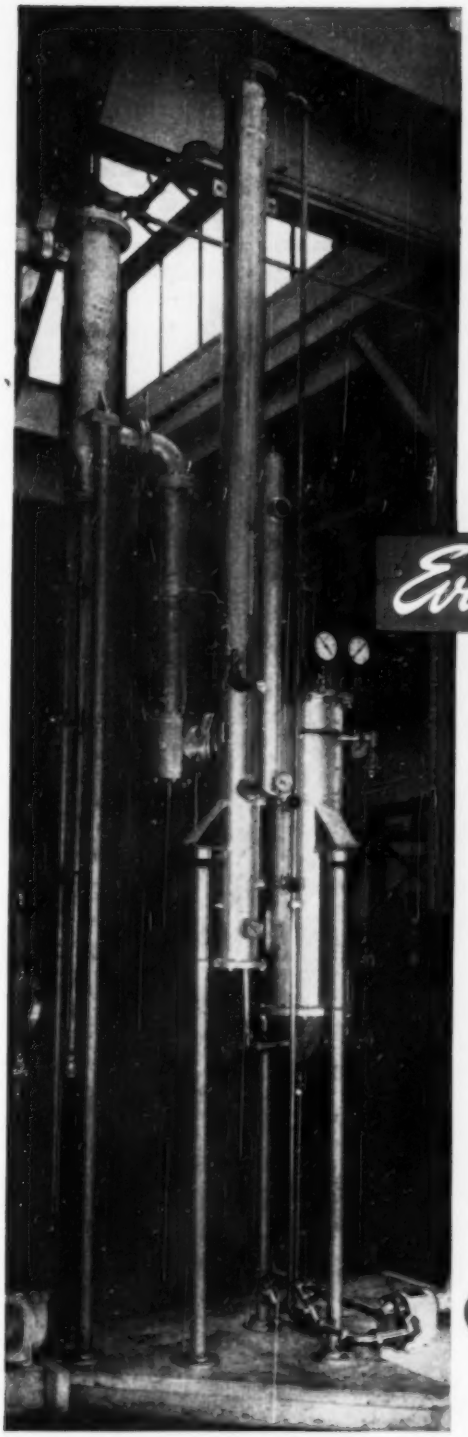
The Model 40 Pneumatic Controller is available for temperature, pressure, flow, liquid level, humidity, density, etc., in a full range of control actions and combinations. Write for Bulletin 381.
**The Foxboro Company, 262 Neponset Avenue, Foxboro, Mass., U. S. A.**



**FOXBORO**
REG. U. S. PAT. OFF.

**M-40**

***"THE FINEST MODERN CONTROLLER"***



# BUFLOVAK
## LOW-TEMPERATURE
# EVAPORATORS

Operating at extremely low temperatures and safe pressures, the new BUFLOVAK Low-Temperature Evaporators safeguard the good qualities of your concentrated product. Delicate materials are concentrated safely, quickly . . . and with a HIGH RECOVERY OF SOLIDS.

Successful and profitable operations, day after day, and over long operating periods, are assured by automatic controls.

Profits are increased by maintaining high product quality, at low production cost! There are no royalties to deduct from profits! BUFLOVAK equipment is sold outright with protective performance guarantees!

## *Evaporation at 58°F*

The illustration shows a low-temperature evaporator in the BUFLOVAK Research Laboratories that is available for your experimental work.

Other BUFLOVAK Equipment for processing chemicals and foods include Dryers, Solvent Recovery Equipment, and Processing Equipment. Literature on request.

**BUFLOVAK EQUIPMENT**

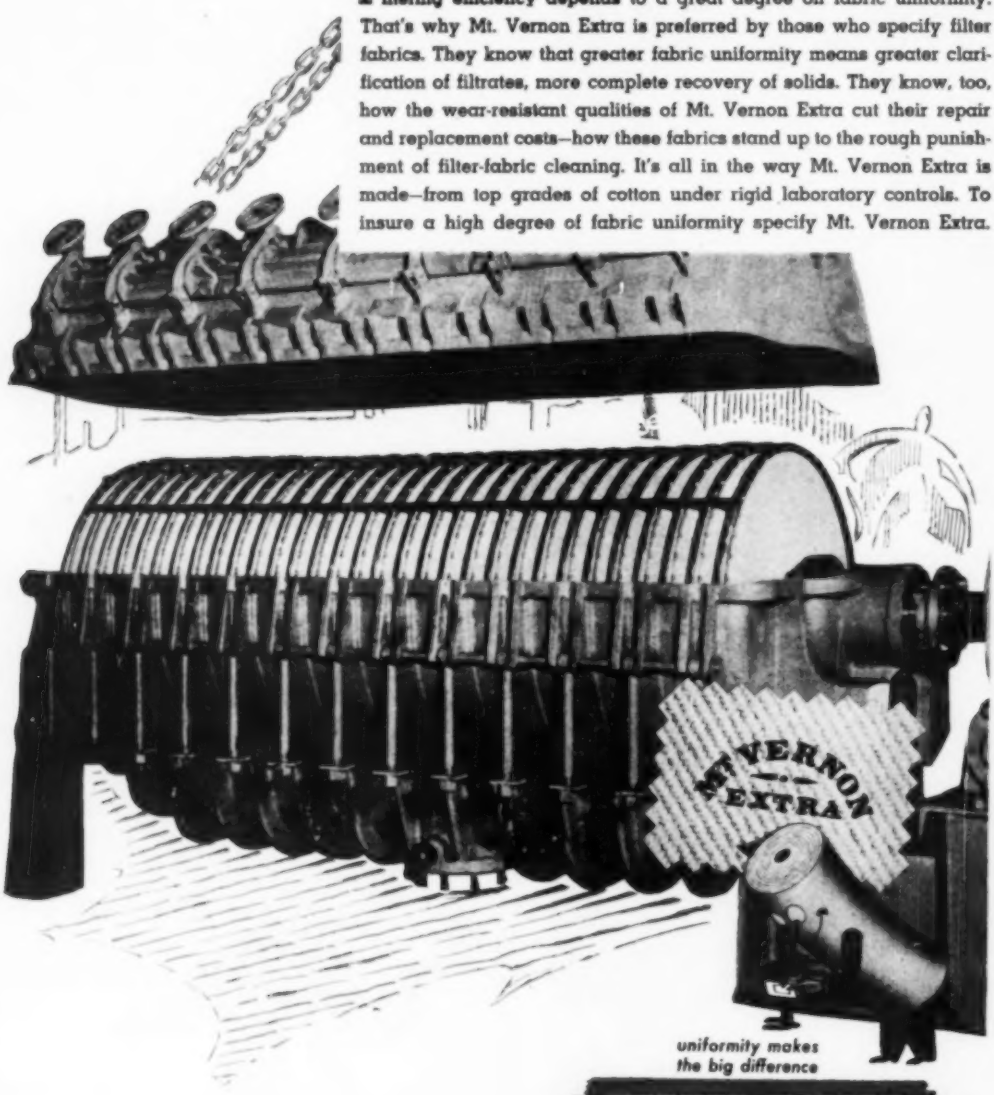
*Division of Blaw-Knox Co.*

**1551 FILLMORE AVE. BUFFALO 11, N. Y.**



# *Filtering Starts with the Fabric*

**Filtering efficiency depends** to a great degree on fabric uniformity. That's why Mt. Vernon Extra is preferred by those who specify filter fabrics. They know that greater fabric uniformity means greater clarification of filtrates, more complete recovery of solids. They know, too, how the wear-resistant qualities of Mt. Vernon Extra cut their repair and replacement costs—how these fabrics stand up to the rough punishment of filter-fabric cleaning. It's all in the way Mt. Vernon Extra is made—from top grades of cotton under rigid laboratory controls. To insure a high degree of fabric uniformity specify Mt. Vernon Extra.




*uniformity makes the big difference*

***Mt. Vernon-Woodberry Mills***

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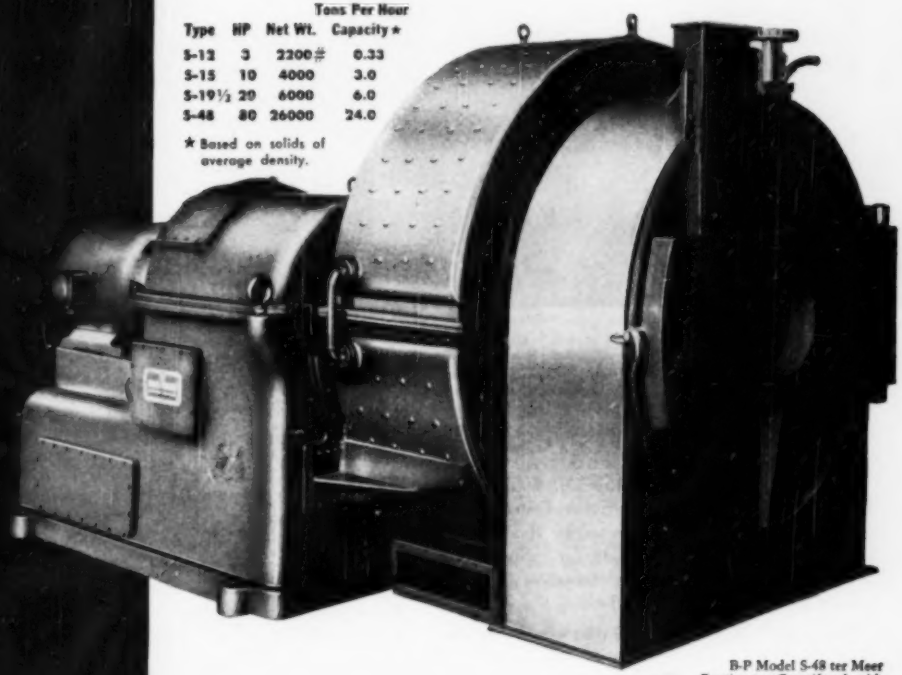
# NEW TYPE "S" B-P TER MEER CONTINUOUS CENTRIFUGALS

## *speed production of free draining slurries*

The new Baker Perkins Type "S" ter Meer Continuous Centrifugals now de-water greatly increased quantities of free draining crystalline, granular and fibrous materials. The new Model S-48, for example, can now de-water up to 24 tons of material* per hour, as compared with 8 to 10 tons per hour in the old model. Other re-designed models have *increased production capacities on an average of 50 per cent.* These new B-P Centrifugals have jacketed wet housings as optional equipment in which hot or cold liquids or gasses can be circulated for controlling working temperatures. An inspection door in the discharge chamber can be opened for close observation of centrifuging while the machine is in operation and makes the machine readily accessible for cleaning.

| Type | HP | Net Wt. | Tons Per Hour Capacity ★ |
|---|---|---|---|
| S-12 | 3 | 2200# | 0.33 |
| S-15 | 10 | 4000 | 3.0 |
| S-19½ | 20 | 6000 | 6.0 |
| S-48 | 80 | 26000 | 24.0 |

★ Based on solids of average density.

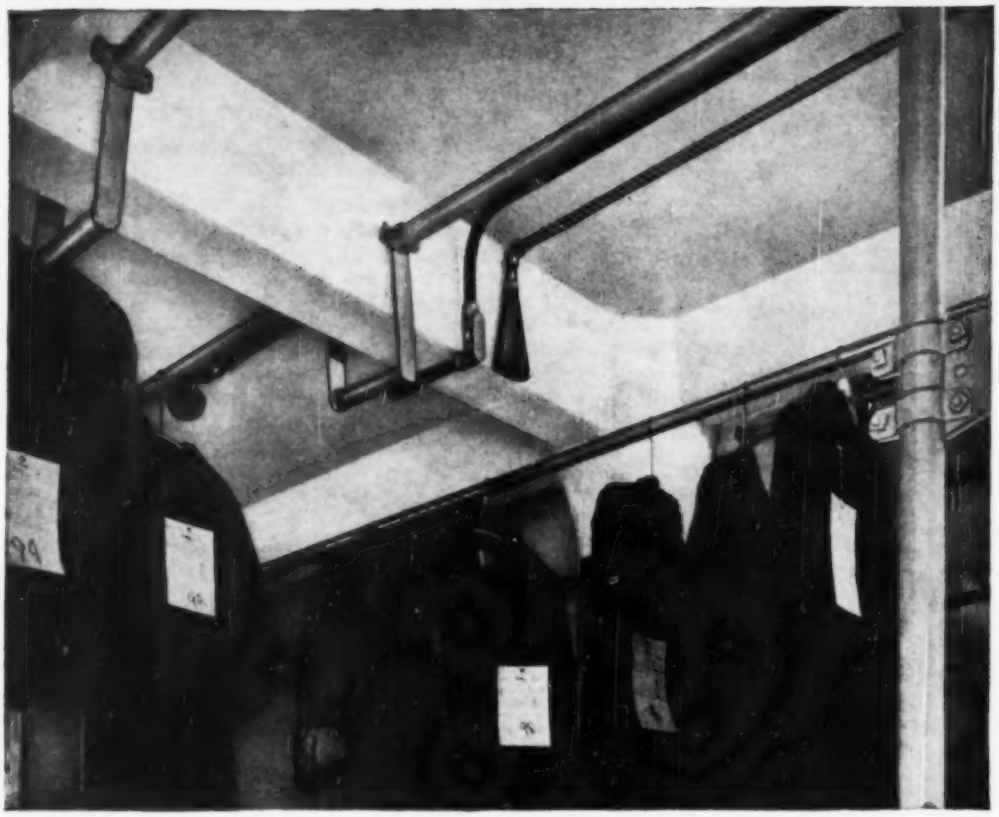


B-P Model S-48 ter Meer Continuous Centrifugal with 48" drum; develops 250 x G with 50 HP drive motor; and 30 HP oil pump motor. Write for complete information.

**BAKER PERKINS INC.**

*Chemical Machinery Division,* **SAGINAW, MICHIGAN**

# There's a cool $10,000,000 here...



## —that won't go up in smoke!

Pack hundreds of costly furs into a storage vault—and you have an investment that takes a whale of a lot of watching!

At Merchants Transfer & Storage Co., Washington, D. C., the electric eyes of *Kidde* Smoke Detectors are *constantly* on watch. Supplemented by Heat Actuators, they send a *Kidde** automatic fire-extinguishing system into action at the first threat of fire. The system smashes the threat by flooding the vault . . .

With *water?* Not on fur coats that would turn into sodden masses! No, the *Kidde* system uses dry, clean carbon dioxide ($CO_2$) that's deadly to *fire*, harmless to *materials*.

The places in *your* plant where you store business documents—contracts, deeds, drawings, formulas, important correspondence—present fire hazards much like fur vaults. Your valuable papers *need* fire protection—but they're useless if water-soaked! For applications like this, $CO_2$ is the ideal extinguishing agent . . .

***And when you think of $CO_2$, call Kidde!***

*Also known as "LUX."

The words "Kidde" and "Lux" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

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## all this helpful TUBING Data

Whatever your questions about Republic ELECTRUNITE Tubing, you'll find the answers in this helpful literature:

1. Boiler, Heat Exchanger and Condenser Tube Brochure.
2. Stainless Steel Tubing and Pipe Handbook.
3. Mechanical Tube Tolerance Guide.
4. Process Industries Tubing Brochure.
5. General Product Design Brochure.
6. Electric Metallic Tubing Brochure.
7. Structural Steel Tubing Brochure.
8. Dewey Process for Configured Tubing (Description of)
9. Structural Steel Tubing Fabricating Guide
10. Boiler Tube Maintenance Chart.
11. Size Range Cards.

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STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York

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Republic Steel Corporation, Steel and Tubes Division
Department B, 224 East 131st Street, Cleveland 8, Ohio
Please send me the tubing data which I have checked below:

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*City* _____ *Zone* _____ *State* _____
1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____
7. _____ 8. _____ 9. _____ 10. _____ 11. _____

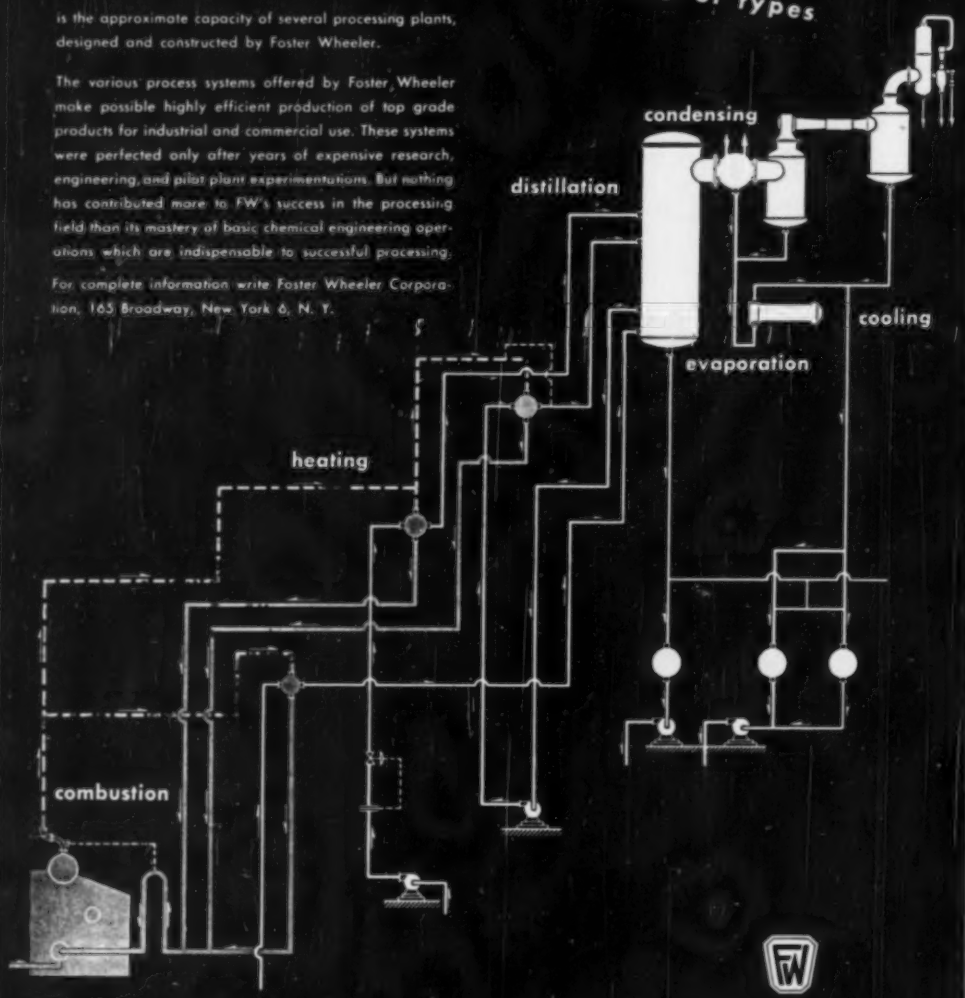
## 150 MILLION POUNDS OF FATTY ACIDS PER YEAR

*in a variety of types*

is the approximate capacity of several processing plants, designed and constructed by Foster Wheeler.

The various process systems offered by Foster Wheeler make possible highly efficient production of top grade products for industrial and commercial use. These systems were perfected only after years of expensive research, engineering, and pilot plant experimentations. But nothing has contributed more to FW's success in the processing field than its mastery of basic chemical engineering operations which are indispensable to successful processing.

For complete information write Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.




FOSTER WHEELER

165 BROADWAY, NEW YORK 6, NEW YORK

# HERE'S WHY ENGINEERED LAYOUTS CUT PROCESSING COSTS

**When your processing setup is laid out by Farrel-Birmingham engineers, each machine is *matched in capacity* with the other units in the production line.**

**This assures free-flowing production without costly interruptions caused by the "choking" or "starving" of some of the units. You receive maximum return on your investment because *all* machines are working full time, at capacity.**

**Another advantage of such an *engineered* layout is the reduction in the manual aid and supervision required. In some cases an individual machine will require no operator at all.**



For further details of this engineering service, as well as a brief outline of Farrel-Birmingham equipment, send for new bulletin No. 187. Just fill out the coupon and drop it in the mail.

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Aluminum does not rust.

Does that suggest an important application in your cooling process? And did you know that certain physical properties of aluminum actually improve at low temperature? This we have proved, in the course of investigations we conducted jointly with the Batelle Memorial Institute, to perfect processes and techniques for the welding of thick-section aluminum structures.

Now we are welding up to 3" aluminum, using original equipment, of new designs, for butt welding by the Argon-shielded tungsten-arc process. The results have been phenomenal. During the past year we have completed many orders for a wide variety of vessels and exchangers fabricated by this method—from Alloy 3S aluminum—for service at temperatures as low as minus 320° F.

Our complete facilities are available to you—for the fabrication of a single item or large quantities, either direct or on a contract basis. Using many originally developed methods and equipment, we offer production capacity for the brazing, welding, tube-rolling and x-raying of aluminum in standard or thick sections. May we show you how aluminum will improve the durability of your process equipment—and reduce your replacement and maintenance costs?

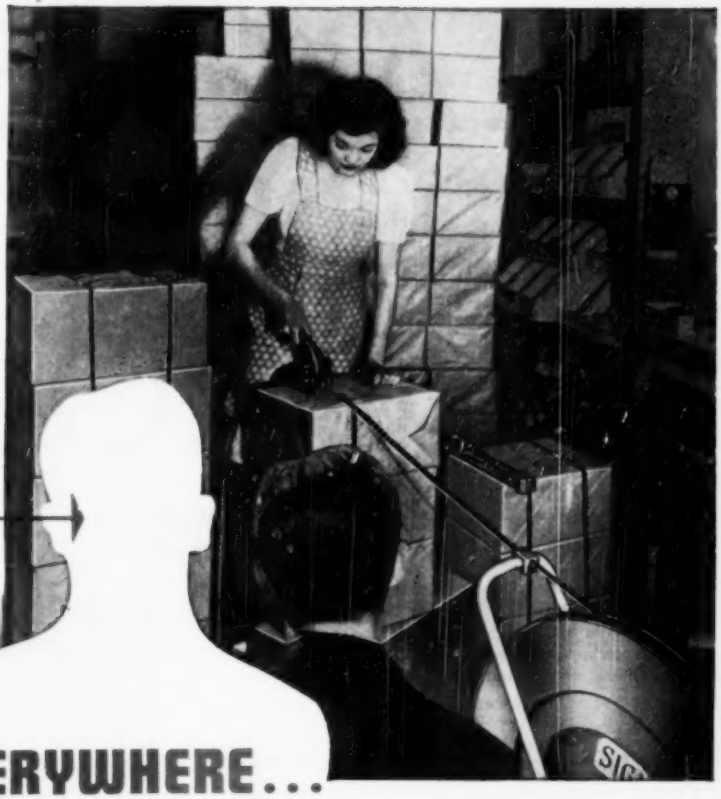
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*One of the Dresser Industries*
5535 VINE STREET • CINCINNATI 16, OHIO




● Write for your copy of this interesting new bulletin, explaining our facilities and illustrating our experience in the field of aluminum fabrication. Ask for Bulletin A-48.

**Stacey Brothers**
**METAL FABRICATORS**

One of the most important factors in the selling of toys is the assurance that shipments are delivered in perfect condition. The young lady is using a Signode K Stretcher to tension ⅝" x .015 Signode steel strapping fed from a model B reel. NOTE: Three packages make up a shipping unit—thus saving on handling and transportation charges.



# He's proved its worth in shipping rooms— EVERYWHERE...

# SIGNODE'S SIX-POINT SYSTEM!

When cost sheets show a steady rise in packaging and shipping costs—attributable to poor protective methods—it's time to ask a SIGNODE packaging and shipping engineer for the facts about SIGNODE'S Six-Point System of Planned Protection!

This system has proved itself practical in shipping rooms all over the world. It stops losses . . . stops damage . . . stops pilferage. And it is now in use by more than 700 *different* industries.

Trained SIGNODE engineers, veterans of thousands of successful applications of SIGNODE'S Six-Point System, are ready to help you find a satisfactory and economical way to cut your packaging and shipping costs. Write, phone or wire them today. No obligation to you whatever!

**HERE'S SIGNODE'S SIX-POINT SYSTEM!**

1. On-the-job survey of your shipping requirements
2. Test-proved recommendation of right strapping
3. Test-proved recommendation of proper strapping tools
4. Recommendation of the right seal
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We want to know how Signode's Six-Point System of Planned Protection can improve our packing and shipping methods. Have Signode engineer call ☐. Send Signode's new "Answer Book" ☐.

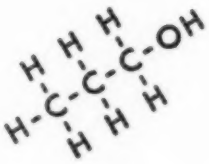
We ship.....in Cartons ☐ Crates ☐ Boxes ☐ Bags ☐ Bales ☐ Bundles ☐ in Carloads ☐ LCL ☐

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Address.....

City.....Zone.....State.....

# CELANESE* n-PROPYL ALCOHOL *in Volume*



**Celanese production of n-propyl alcohol is now meeting large-scale demands. This straight chain alcohol—applicable to processes where its characteristic excellent solvent action and miscibility can be used to advantage—is available for shipment in drum or tank car amounts.**

**PHYSICAL PROPERTIES**

| | | |
|---|---|---|
| MOLECULAR WEIGHT | | 60.09 |
| COLOR | | water white |
| ODOR | | characteristic alcohol-like odor |
| SPECIFIC GRAVITY | 20°/4° C | 0.8044 |
| DISTILLATION RANGE | ASTM °C | 2° including true boiling point |
| WEIGHT PER GALLON | 20° C | 6.7 lbs. |
| SOLUBILITY | | soluble in water and practically all organic solvents |
| FLASH POINT | open cup | 85° F |
| BOILING POINT | 1 atm. | 97.2° C |
| FREEZING POINT | | −127° C |
| VAPOR PRESSURE | 100° F | 0.9 lbs. per sq. in. absolute |
| RELATIVE EVAPORATION RATE | | 11.1 (ether = 1) |

If you are looking for an improvement in your products, or short cuts in processing, the straight chain advantages of n-propyl alcohol are worth investigation. n-Propyl alcohol allows the solvent user greater solvent formulation freedom and can be used as a replacement and extender for higher alcohols. Call or write for additional information and specifications.

CELANESE CORPORATION OF AMERICA,
Chemical Division,
180 Madison Avenue, New York 16, N.Y.

## Celanese®

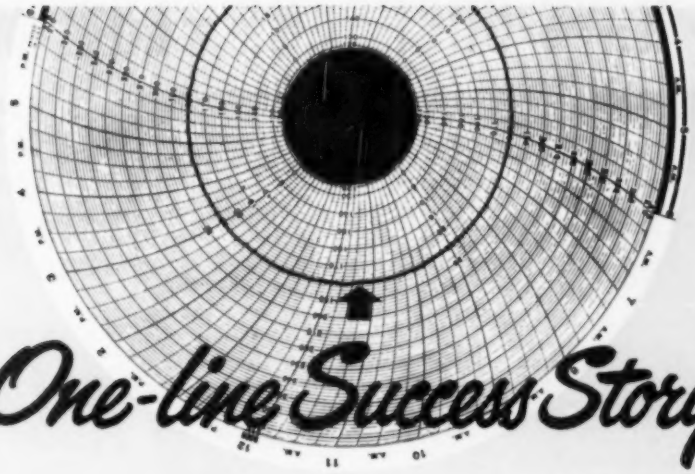
**U. S. P. FORMALDEHYDE**

**Formaldehyde, one of the most important products in the growing family of Celanese Organic Chemicals, is now offered in greater volume. This high quality, U.S.P. chemical is sold commercially as Formalin, a water white solution containing 40% formaldehyde by volume, 37% by weight. It is obtainable in both methanol inhibited and uninhibited grades.**



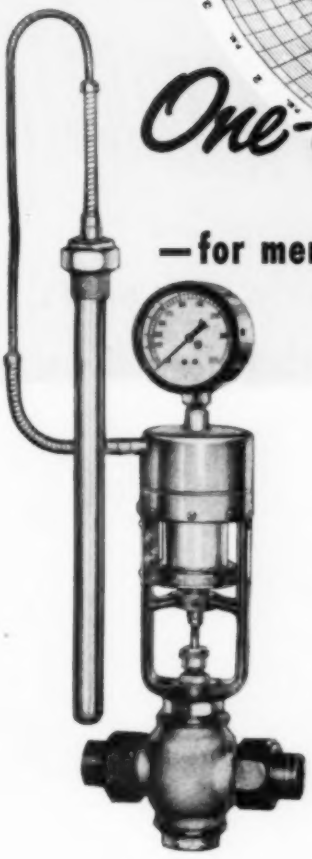

*Reg. U. S. Pat. Off.

**ALDEHYDES · ALCOHOLS · ACIDS · SOLVENTS · GLYCOLS · KETONES · PLASTICIZERS**



# One-line Success Story

## —for men who seek process improvements



There's a "success story" in the temperature chart shown above—of equal importance to processors as well as the men who make processing equipment.

To processors of food, chemicals, textiles or a host of other commodities, the uniform reading on the chart shows how Sylphon Temperature Regulators, attached to processing equipment, help maintain desired product-quality . . . help prevent spoilage . . . eliminate wasteful overheating.

To the equipment manufacturer, the chart shows how these regulators, as standard equipment, help insure the satisfactory performance of the machines you make.

Fulton Sylphon can help you be certain of a control that's *right* for the job. Specialists in this field for 44 years, we've developed accurate temperature regulators for practically all processing needs. No. 923-T shown at left is typical. Available with or without thermometer.

Rugged, compact, self-contained and self-powered, they are built for long, trouble-free service. Write today for Catalog EC-20 that gives complete details on the full line.

FS

FIRST WITH BELLOWS

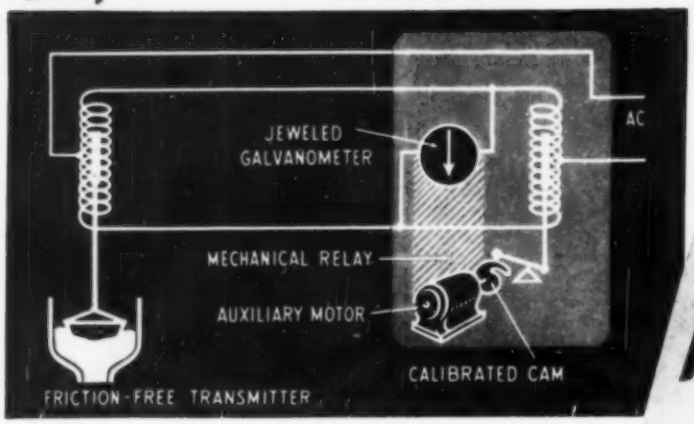
*Temperature Controls • Bellows Devices • Bellows Assemblies*

**FULTON SYLPHON**
DIVISION

ROBERTSHAW-FULTON CONTROLS CO., KNOXVILLE 4, TENN.

*Canadian Representatives, Darling Brothers, Montreal*

# *Why* HAYS-COCHRANE FLOW METERS



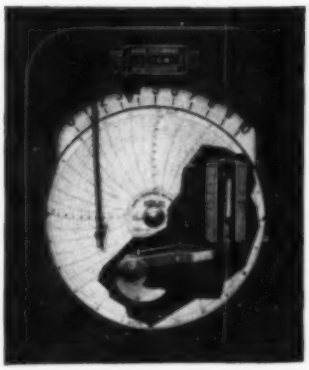

## *Stay ACCURATE*

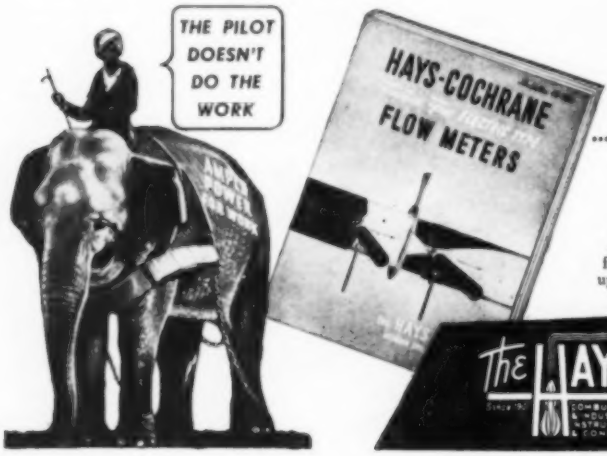
- ***The friction-free transmitter acts only as a pilot.....***
- ***Actuates an external motor drive that does the work***

An extremely difficult metering job provides an ideal demonstration of the dependable accuracy and freedom from maintenance built into Hays-Cochrane Flow Meters.

Unlike most flow meters, the sensitive measuring circuit is relieved of all work of indicating, integrating and recording.

For durability, readability, reliability—specify Hays-Cochrane Flow Meters.



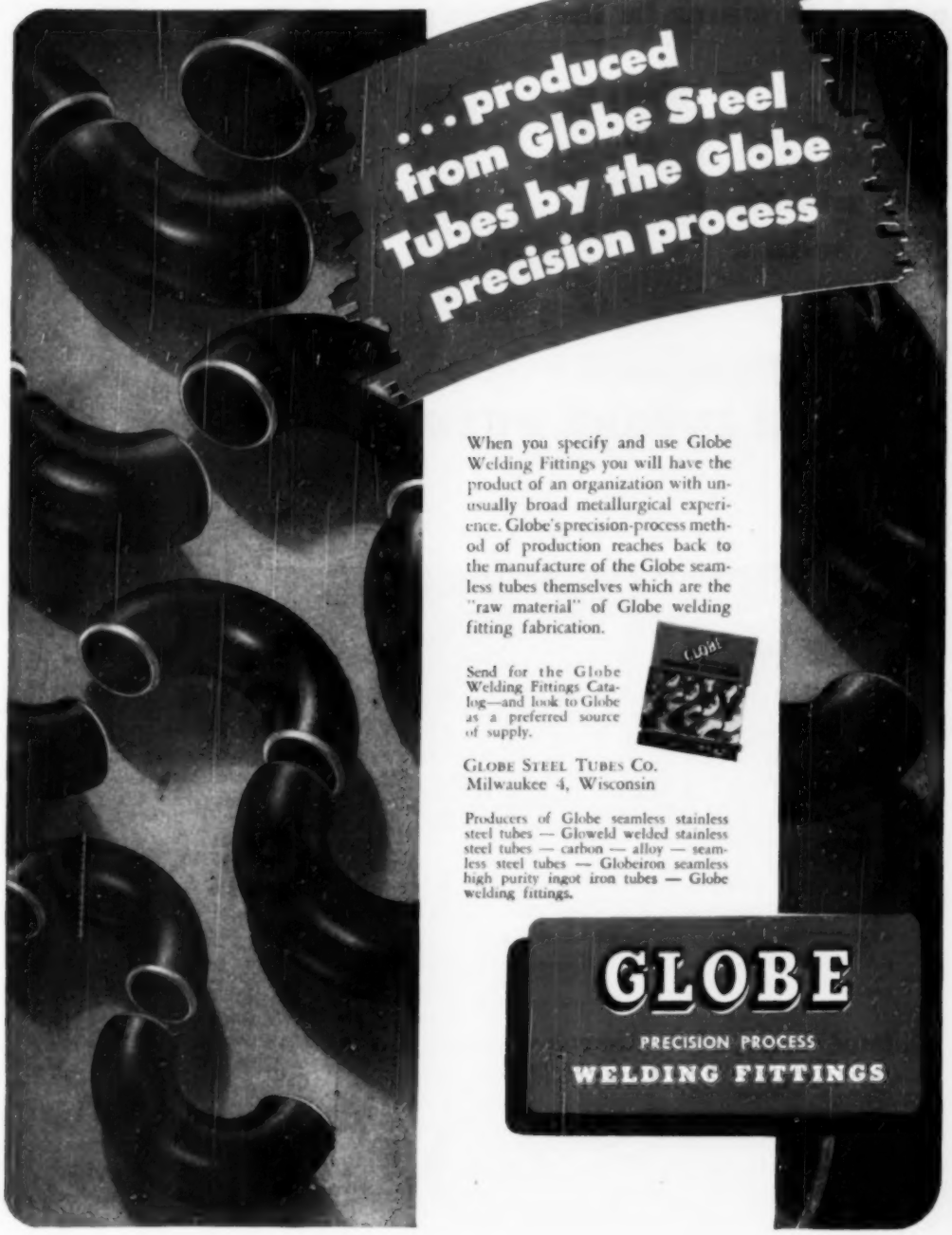



### YOU'LL WANT THIS BOOK

For full information on these modern electrically operated flow meters—how they are made, how they work, how they keep their accuracy through long continuous service—send for Bulletin 49-800. It's a "must" for every up-to-the-minute data file.

**The HAYS CORPORATION**
COMBUSTION & INDUSTRIAL INSTRUMENTS & CONTROLS
MICHIGAN CITY, INDIANA, U.S.A.

# GLOBE WELDING FITTINGS



## . . . produced from Globe Steel Tubes by the Globe precision process

When you specify and use Globe Welding Fittings you will have the product of an organization with unusually broad metallurgical experience. Globe's precision-process method of production reaches back to the manufacture of the Globe seamless tubes themselves which are the "raw material" of Globe welding fitting fabrication.



Send for the Globe Welding Fittings Catalog—and look to Globe as a preferred source of supply.

GLOBE STEEL TUBES CO.
Milwaukee 4, Wisconsin

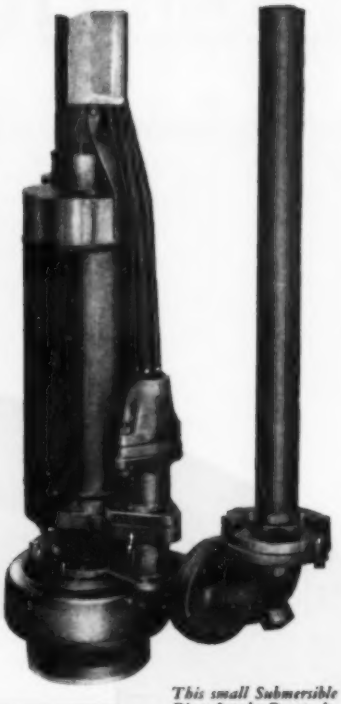
Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe welding fittings.

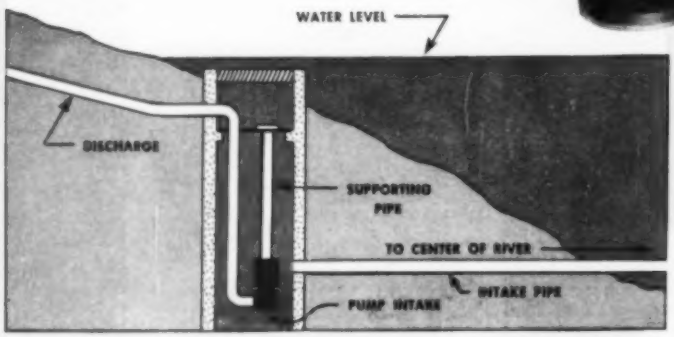
**GLOBE**
PRECISION PROCESS
**WELDING FITTINGS**

**Pumping from lake or river?**
**. . . with icing in winter?**
**and high water in the spring?**

get *Under* the trouble with a **BJ**

# SUBMERSIBLE RIVER INTAKE PUMP






*This small Submersible River Intake Pump delivers river water at 100 gpm against a 55 ft. head. Consistent water delivery in spite of 40° below zero North Dakota Winter temperatures and Spring high water 45 feet above the pump intake.*

CAPACITIES: to 5000 gpm
MOTOR SIZES: 7½ to 350 hp
INSTALLATION: Vertical, Horizontal, or on an incline

**Down at the bottom** of the river or lake it doesn't matter about ice or high water. That's why the Submersible is the logical solution to this kind of pumping problem. It operates regardless of surface conditions.

**Sealed oil-filled submerged motor** is close-coupled direct to pump (pump can be any one of several different types).

**Starting panel** (equipped for manual or automatic starting) can be located at any convenient point above flood stage. Discharge pipe should be buried enough to eliminate freezing.

**Many other advantages.** Easy to install. Simplified intake structure. No adjustments. No pump house. Operates for months without attention. Safe against vandalism.

**Byron Jackson Co.**
*Established 1872*
**LOS ANGELES 54, CALIFORNIA**
*Offices in Principal Cities*




"All that I am I owe to Reeves Speed Control"

**THE 3 BASIC REEVES UNITS**

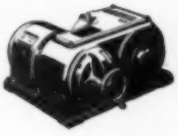
**VARIABLE SPEED TRANSMISSION** for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



**VARI-SPEED MOTOR PULLEY** provides an instantly variable speed drive within 4:1 ratio for any constant speed moto. Sizes to 15 hp.



**MOTODRIVE** combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 20 hp.



REEVES Speed Control releases the full capacities of production workers . . . enables operators to vary machine speeds instantly and accurately to match differences in skill or number of workers and to meet the needs of different operations. Results: Faster output . . . higher, more uniform quality of product . . . fewer rejects. Install REEVES Variable Speed Drives on your present machines, and always specify REEVES-controlled machines when you buy new equipment.

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***Recognized Leader in the Specialized Field of Speed Control Engineering***

ACCURATE • VARIABLE

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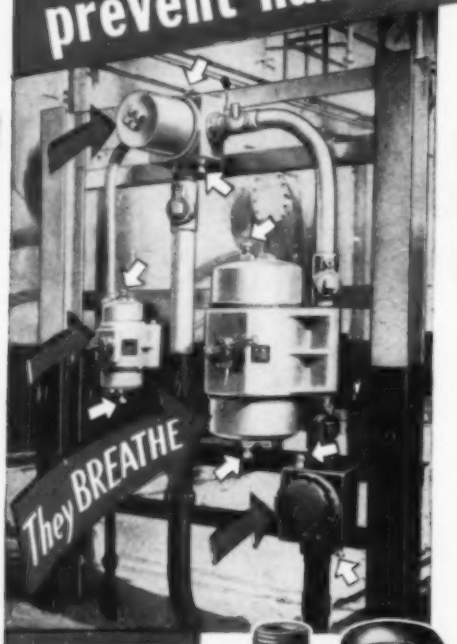
GIVES THE RIGHT SPEED FOR EVERY JOB!

# CROUSE-HINDS Breathers

## prevent harmful water condensation

in explosion-proof electrical conduit systems

## under humid conditions




- **FORESTALL** the formation of destructive mildew by ventilating enclosures.
- **EXTEND the LIFE** of insulation and equipment under adverse conditions.
- **MINIMIZE** the danger of expensive shut-downs due to insulation or equipment failure.

Paragraph 5015-C5 of the 1947 National Electrical Code states that "*where there is a possibility that water or other condensed vapor may be trapped at any point in the raceway system, approved means shall be provided to prevent accumulation, or to permit periodic draining of such water or condensed vapor*"

Explosion-proof electrical enclosures cannot be vented in any of the usual ways because they must be kept flame-tight. Crouse-Hinds' explosion-proof Type ECD Breathers, Type ECD Drains, and Type EZD Drain Sealing Condulets meet the Code requirements and are listed by Underwriters Laboratories for such service.

The Breathers are similar to the Drains but have metal hoods which make them water and dust shedding. Both have corrosion-resisting bodies with internal flame-tight (but not airtight or watertight) labyrinths. They can be used freely without impairing the explosion-proof integrity of a conduit system, providing they are always installed in a Condulet hub or other opening *with five or more full threads engaged*.

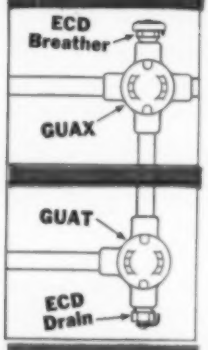
In humid atmospheres, water condensation occurs in explosion-proof systems, especially where temperature changes are frequent. Accumulation of water in harmful quantities is common. Mildew, a bacterial growth, is often present. It attacks many insulations and will destroy them unless the cause is removed. In such humid atmospheres troubles of this nature can be avoided by the proper installation of Crouse-Hinds' Breathers and Drains in conjunction with explosion-proof Condulets*.

Breathers should be placed at the highest points and Drains at the lowest points of all housings and conduit runs. Heat generated by the current flowing through conductors and electrical devices raises the temperature of air within the conduit and housings. Breathers and Drains permit the resultant upward passage of the warmed air to remove moisture and thoroughly ventilate the enclosures. This prevents the accumulation of water and removes moisture that may have collected under unusual conditions.

This method is successfully used in many of the largest plants in the chemical and petroleum industries. Several years of field experience has demonstrated that the moisture is either entirely removed by ventilation, or so reduced that it is not harmful.

These devices have also been successfully used in non-hazardous locations where condensation is troublesome.

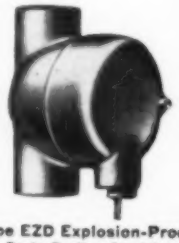
If you have a condensation problem, Crouse-Hinds Company will gladly assist in solving it. Write to






Type ECD Drain — Type ECD Breather

**CONDULETS with Crouse-Hinds Breathers and Drains can be installed for ventilation throughout an entire explosion-proof conduit system**



Type EZD Explosion-Proof Drain Sealing Condulet

A Nationwide Distribution Through Electrical Wholesalers

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### Syracuse 1, N. Y.

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* *CONDULETS are made only by CROUSE-HINDS*

**CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS**

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MONO-BLOCK

. . . the one-block insulation

made with **BLACK** ROCKWOOL




effective to

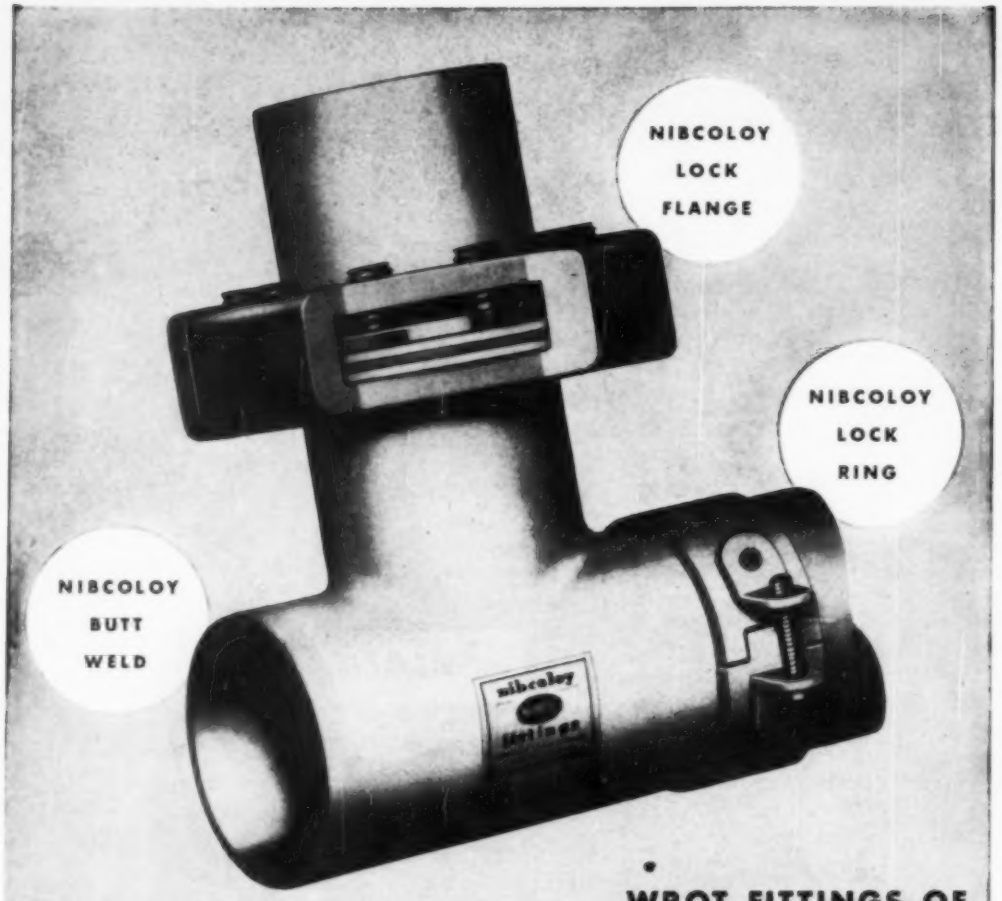
*Send for free copy of our catalog "Industrial Insulation" which describes B-H MONO-BLOCK and other Baldwin-Hill Insulations.*

**Baldwin-Hill Company, 701 Breunig Ave., Trenton, N. J.**

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# Nibcoloy

## WROT FITTINGS OF STAINLESS STEEL AND NICKEL ALLOYS

To insure sanitation and resist corrosion in fluid process piping use light gauge tubes with NIBCOLOY WROT Fittings, formed from the same tube used for the pipes. This provides a complete installation with identical physical and metallurgical characteristics!

For quickly demountable piping use the new NIBCOLOY LOCK FLANGE Fitting. Makes a perfect joint that's easy to open for cleaning, renewing gaskets or changing the line itself. NIBCOLOY WROT Fittings are precision-formed, by a patented process, to close tolerances and highest quality standards. Available from ¼" O.D. to 4" O.D. in Monel, Inconel, Nickel and Stainless Steel 304—347—316. Mail coupon or write now for Catalog 902 with detailed information.

**NORTHERN INDIANA BRASS CO., 302 Plum St., Elkhart, Indiana**

Without obligation send us your Catalog 902 on Nibcoloy Wrot Fittings.

Individual _____

Company _____

Street _____

City _____ State _____

# Compare

**PERMUTIT DEMINERALIZED WATER WITH DISTILLED WATER**

**FOR PRICE**

**RAW WATER ANALYSIS AND REGENERANT COSTS:**

| ppm * | PLANT A | PLANT B | PLANT C |
|---|---|---|---|
| Hardness | 43 | 116 | 302 |
| Alkalinity | 34 | 58 | 227 |
| Sulfate | 19 | 70 | 60 |
| Chloride | 4 | 2 | 25 |
| Total Electrolytes | 64 | 149 | 337 |
| Regen. Costs per 1000 gals. | $0.03 | $0.08 | $0.16 |

*ppm as $CaCO_3$

**FOR QUALITY**

**PERMUTIT DEMINERALIZED WATER PLANTS**

| ppm * | PLANT A | PLANT B | PLANT C |
|---|---|---|---|
| Hardness | 0 | 0 | 1 |
| Alkalinity | 2 | 3 | 4 |
| Sulfate | 0 | 0 | 1 |
| Chloride | 0 | 0 | 0 |
| Total Electrolytes | 2 | 3 | 5 |

*ppm as $CO_3$

PERMUTIT DEMINERALIZED WATER saves you as much as 95% of the cost of distilled water and may be used in almost every case where distilled water is suitable. Permutit has available a full line of Water Demineralizing Equipment . . . installations have been made ranging from 100 to 40,000,000 gpd. Check the advantages and ease of switching from distilled water to Permutit Demineralized Water.

Write for full information to The Permutit Company, Dept. CE-3, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., Montreal.

*FOR 35 YEARS*
*WATER CONDITIONING*
*HEADQUARTERS*

Permutit

# Experience!

Some of the multitudinous types of chemical process equipment designed and built by "PARACOIL".



The Chemical Industry has long evidenced a PREFERENCE FOR PARACOIL in the design and fabrication of its varied process equipment needs.

This preference is based on the *Proven Products* of our Elizabeth shops.

"PARACOIL" has been building diversified chemical process equipment since 1915. It offers the Industry that surety of performance that can only be attained through *Years of Experience.*

*We Solicit Your Inquiries.*

**DAVIS**
**ENGINEERING CORPORATION**
1064 East Grand Street, Elizabeth 4, N. J.
BUY OR SPECIFY "PARACOIL"

# SMALL TRAP

# BIG *Performance*

*Little? Sure. But what a giant's job they do:*

That's how men judge Yarway Impulse Steam Traps.

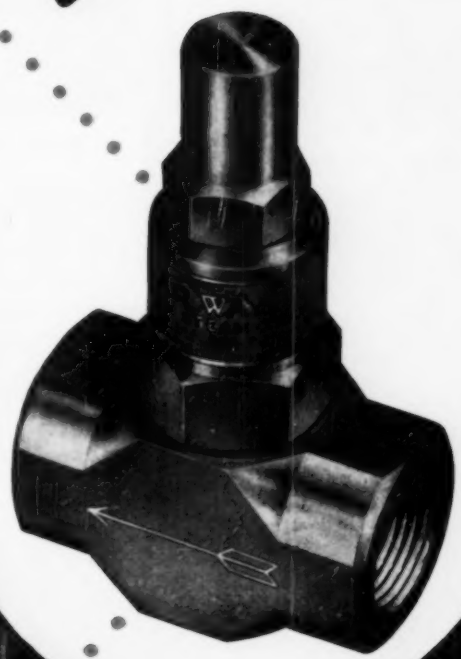
Yarways are well suited for trap service throughout industry. The small size itself is an important feature. They are easy to install, fit in anywhere, require no special supports.

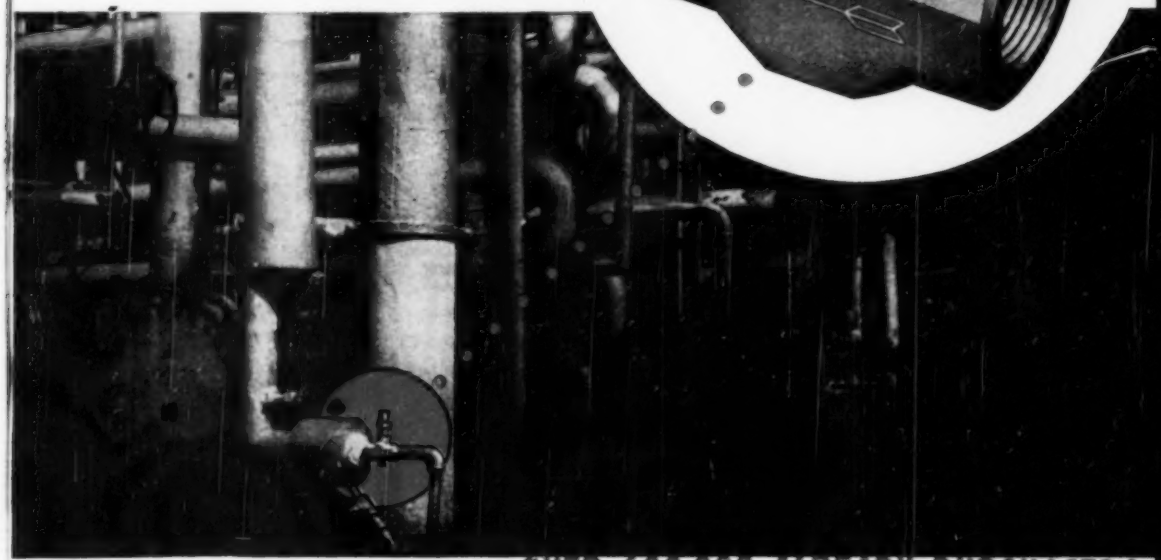
In service they *drink* condensate, discharging *continuously* on heavy loads, at short *intervals* on light loads—providing maximum heat in the shortest time, and keeping equipment at top efficiency.

Yarways are suitable for all pressures without change of valve or seat. Simplicity of construction (only one moving part) minimizes maintenance. Also, initial cost is low.

Try some Yarways today—standardize on them tomorrow. See your nearest Supply House or write for Yarway Bulletin T-1739.

**YARNALL-WARING COMPANY**
**137 Mermaid Avenue, Philadelphia 18, Pa.**





*OVER 600,000 ALREADY PURCHASED!*

**YARWAY IMPULSE STEAM TRAP**

# GAIN DEPENDABLE BREATHING SAFETY

## Supplied Air Masks



★ M.S.A. HOSE MASKS: supply fresh air through hose to wearers in confined spaces; hand- or motor-operated blowers.



★ M.S.A. BLASTFOE ABRASIVE HELMET: lightweight protection for the sandblaster. Aluminum headpiece, replaceable rubber hood.



★ M.S.A. AIRLINE RESPIRATOR: uses compressed air for breathing, under exact control, in contaminated atmospheres.



★ M.S.A. ABRASIVE MASK: heavy-duty, durable protection for shot- and sandblast operators.

SAFETY EQUIPMENT HEADQUARTERS

MSA

## Oxygen Apparatus



★ M.S.A. CHEMOX: makes its own oxygen—as you breathe—in replaceable chemical canister. 45-minute protection.



★ M.S.A. DEMAND MASK: ½-hour supply of air or oxygen, demand-regulated, with back-carried high pressure cylinder.



★ McCAA TWO-HOUR OXYGEN BREATHING APPARATUS: for rugged, extended service in unbreathable air.

## Dust and Fume Respirators



★ M.S.A. DUSTFOE RESPIRATOR: All-Dusts protection. Formable aluminum facepiece, transparent filter container.



★ M.S.A. COMFO RESPIRATOR: twin, large-area filters for all dusts. Comfo cushion facepiece provides airtight seal on face.



★ M.S.A. METAL FUME RESPIRATOR: special filters for protection against harmful metal fumes. Comfo facepiece.

PLUS VITAL WEARING COMFORT—WITH

# the *Complete Line* of RESPIRATORY PROTECTION

*for every breathing hazard on any industrial job*

★ U. S. BUREAU OF MINES APPROVED

## Canister Gas Masks



★ M.S.A. TYPE "S" ALL-SERVICE GAS MASK: protects against smoke and all industrial gases, including carbon monoxide.



★ M.S.A. AMMONIA MASK: specialized safety for refrigerant emergencies and repair, with long-life ammonia canister.



★ M.S.A. INDUSTRIAL GAS MASK: protects against individual gases, with a wide selection of specific canisters.



★ M.S.A. TANK GAUGER'S MASK: supersize canisters for hydrogen sulphide, and other petroleum gases and vapors.

## Cartridge Respirators



M.S.A. GASFOE RESPIRATOR: ever-ready protection against light acid gases, organic vapors. Can be worn around neck or carried in pocket.



M.S.A. GAS-FUME RESPIRATOR: multi-purpose type, for light gases, vapors, dusts, fumes. Back-carried, twin replaceable cartridges.



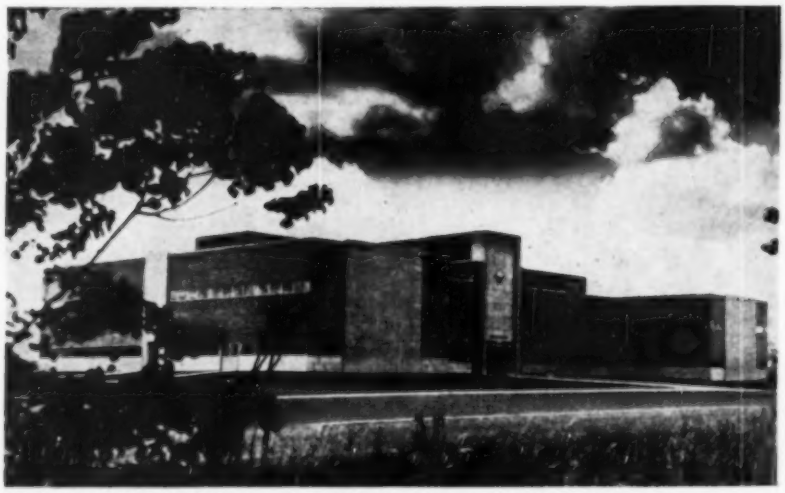
★ M.S.A. CHEMICAL CARTRIDGE RESPIRATOR: twin-cartridge, for paint spray vapor, light acid gases and organic vapors.

**MINE SAFETY APPLIANCES COMPANY**

BRADDOCK, THOMAS AND MEADE STREETS · PITTSBURGH 8, PA.

*At Your Service:*

54 BRANCH OFFICES IN THE UNITED STATES AND CANADA



Westinghouse Air Conditioning System with Kathabar Humidity Control installed by Natkin & Co.

The Shell Oil Company was about to invest $1,300,000 for a new laboratory in Houston, Texas, for oil research. Plans called for extremely critical atmospheric condition control. Temperatures and humidity had to be held constant within close limits. It was essential that the air be kept as free of dusts and pollens as modern science would permit. Laboratory fumes had to be eliminated quickly. Westinghouse Air Conditioning with PRECIPITRON*, the electronic air cleaner, supplied the answer to the air cooling and air cleaning problems—not with special equipment, *but with standard, matched, Westinghouse components.*

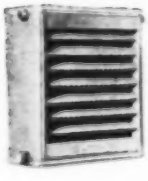
Expensive "special" jobs can often become routine jobs when you specify Westinghouse, because Westinghouse makes more products to put air to work in more different ways, than any other manufacturer. This means undivided equipment responsibility, coordinated system operation, flexibility and economy—important benefits that can hardly be overlooked when you are thinking about air conditioning, air handling, or air cleaning. Call your nearest Westinghouse office, Air Conditioning Distributor, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

# Westinghouse

## Sturtevant Division



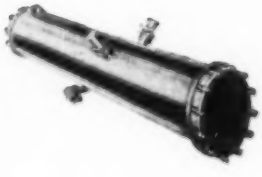
AIR HANDLING UNITS



UNIT HEATERS



CENTRIFUGAL FANS



REFRIGERATION CONDENSERS

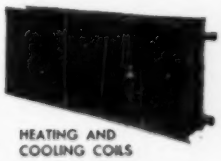
# HOW SHELL BOUGHT PRECISION AIR CONDITIONING FOR LABORATORY ATMOSPHERE CONTROL



REFRIGERATION COMPRESSORS



EVAPORATIVE CONDENSERS



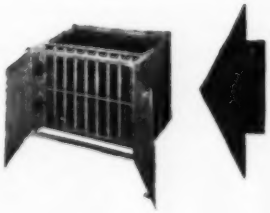
HEATING AND COOLING COILS



UNIT AIR CONDITIONERS



ROOM AIR CONDITIONER



PRECIPITRON*
(ELECTRONIC AIR CLEANER)

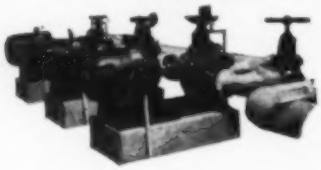
**Everything that puts air to work for Every application**

J-80132

*Reg. U. S. Pat. Off.

# How do

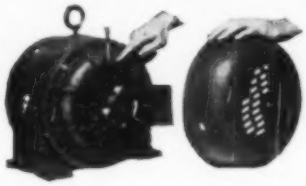
## ON MOTORS



**Q.** As applied to a motor, what does "explosion-proof" actually mean?

1) *That the motor's operation is not affected by external nearby explosions?*
2) *That gastight construction prevents entry of gas or vapors that might explode inside the motor?*
3) *That the motor's enclosure withstands internal explosion and keeps sparks from escaping outside?*

**A.** An explosion-proof motor (Class I Group D) has an enclosure which will withstand an explosion of a specified gas or vapor which may occur within it, and prevent resulting sparks, flashes, or explosions from igniting the specified gas or vapor surrounding the motor. G-E makes the most complete line of motors tested and listed by UL for hazardous locations in chemical plants—in some cases, the only ones so listed. See Bulletin GEA-4131.



**Q.** What's the newest development in corrosion resistance for chemical plant motors?

1) *A newly developed paint immune to acids and alkalies?*
2) *A new type of cooling fan?*
3) *A special grease lubricant for ball-bearings?*

**A.** It's G-E's new Textolite® corrosion-resistant cooling fan, now supplied in all Tri-Clad® totally enclosed fan-cooled motors in ratings from 1 to 15 hp. Added to Tri-Clad's corrosion-resistant cast-iron enclosure, the new fan now makes these standard, off-the-shelf motors available for chemical plant service regardless of the acids and alkalies that may be encountered. It's nonsparking, too, and tested and listed by UL for use in explosion-proof motors for hazardous areas Class I Group D, and Class II Groups E, F, and G. Send for Bulletin GEA-4400 on Tri-Clad totally enclosed motors.

**Q.** If you were placing low-voltage control in a hazardous or semi-hazardous location, what equipment would you specify?

1) *Separate units and wall-mount?*
2) *Circuit breakers separate from starters?*
3) *A factory-assembled group unit?*



**A.** The convenient, time-saving way is to specify a racked-up assembly of G-E combination starters and breakers designed especially for indoor or outdoor chemical plant use. It's a standard, factory-built arrangement, with all control units mounted on a self-supporting framework. Available are corrosion-resisting, oil-immersed, and air-break explosion-proof types, the last two for Class I, Group D locations. Bulletin GEA-3541 gives data on oil-immersed starters.

# GENERAL ELECTRIC

# you rate ? AND CONTROL

**Q.** When you want to combine high-voltage motor control with short-circuit protection in a semi-hazardous area, what do you do?

1) *Order circuit breakers magnetic starters, and overload relays separately?*
2) *Specify group-assembled controllers as one unit?*
3) *Install magnetic starters and provide for short-circuit protection by means of separate safety switches?*



**A.** You would do best by specifying high-interrupting capacity G-E Limitamp controllers, with sealed current limiting fuses which serve both as fuses and disconnect switches. Contactors are oil immersed or in explosion-proof cases. These compact units are completely wired ready to be quickly and inexpensively installed. They are furnished as single units or as a complete group of several units, including incoming oil-circuit breakers and transformer feeders. Check Bulletins GEA-4247 and GEA-3660.

**Q.** For what reason would you specify a motor control center?

1) *It saves space?*
2) *It simplifies future expansion?*
3) *Easy installation and maintenance?*



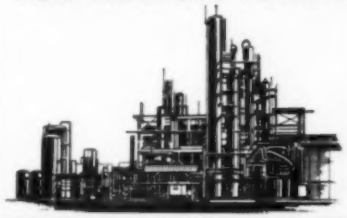
**A.** All three features characterize the new G-E motor control center, with which you can plan the right combination for your plant's needs. Compact, self-enclosed starting units (in four size ranges, from NEMA size 1 to 4, inclusive) fit interchangeably within vertical sections. Front-connected wiring simplifies installation, changes and maintenance. Sections can be placed back to back or against a wall to utilize available plant space. Bulletin GEA-4979 describes the new G-E motor control center.

**G.E. MAKES DOUBLY SURE YOU GET THE RIGHT ELECTRIC EQUIPMENT**

Bring your questions on the selection of motors and control to General Electric. For G.E., over the years, has developed the most complete line of electric equipment to meet specialized chemical plant needs. What's more—to make doubly sure your selection is correct—G.E. teams up two or more engineers to advise you. Specialists who know their particular lines of electric equipment inside out work hand in hand with an "industry" man who is thoroughly at home with chemical plant practice and electrical needs. With their pooled knowledge and experience to draw on, you're certain to meet your requirements practically, economically. Check your nearest G-E office and help yourself to this "extra." For more information on motors and control, send in the coupon.

**MOTORS AND CONTROL**

***FOR CHEMICAL PLANTS***



General Electric Company, Section C662-30
Apparatus Department, Schenectady 5, N. Y.

Please send me the following information on G-E motors and control for refineries.

- ____ *GEA-4131—Motors and control for hazardous locations*
- ____ *GEA-3541—Oil-immersed starters*
- ____ *GEA-4400—Tri-Clad totally enclosed fan-cooled motors*
- ____ *GEA-3660—Limitamp controllers with oil-immersed contactors*
- ____ *GEA-4247—Limitamp controllers with air-break contactors*
- ____ *GEA-4979—Motor control center*

Name .....
Company .....
Address .....
City ..... State .....




# Figuring on a Vacuum Installation?

Then here's a suggestion: There is an engineer in every Ingersoll-Rand branch office who is a specialist in the application of vacuum equipment. Why not give him a call? See what he has to say about your particular vacuum problem. He is convenient to you and is thoroughly qualified by years of experience to recommend vacuum equipment that will give you the most economical results dependent upon plant conditions. Chances are, the equipment best suited to your needs can be selected from the complete range of standard Ingersoll-Rand ejectors. Should it call for a specially engineered selection, then the full scale engineering and research facilities of Ingersoll-Rand will go to work on your problem.



FOR VACUUM EQUIPMENT
*Specify* I-R

- Steam-jet ejectors
- Reciprocating dry vacuum pumps
- Barometric condensers
- Ejector-jet condensers
- Surface condensers
- Vacuum Refrigeration

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165-4




# CIHU?

"One of the great missionary teachers of the twentieth century has small cards printed with the strange word — CIHU? It means CAN I HELP YOU?

"I am De Laval Centrifugal Force. When I replace slower, obsolete methods of separating two liquids, or of removing solids from a liquid, I make the process of separation or clarification continuous. Continuous flow speeds up operation, saves labor and cuts production costs.

"The capacity of De Laval centrifugals depends on the materials being separated. The type of machine called for likewise depends on the application. But — large or small — *all* De Laval machines of a given type do the same job — ***they vary only in capacity.***

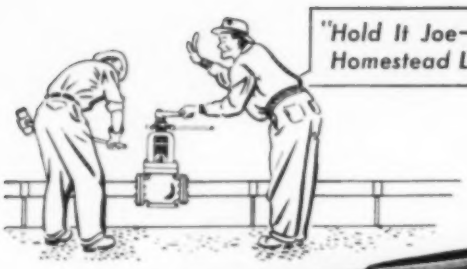
"I have fitted into many plants — CAN I HELP YOU?"

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.



# DE LAVAL CENTRIFUGAL MACHINES

## FOR PROCESSING SYSTEMS




# Homestead
## LEVER-SEALD
# Valves

**ALWAYS WORK**
**LAST LONGER**
**COST LESS PER YEAR**




STICKING valves are never a problem with Homestead Lever-Sealds on the job. Built into each valve is a powerful leverage, ready at all times to overcome the effects of corrosion, viscous fluids or temperature and pressure extremes which cause ordinary valves to stick or "freeze."

This powerful leverage not only relieves pressure between the seating surfaces to permit operation under all conditions; but it also is the means of providing the extra tight seal against leakage—the seal which keeps corrosive or erosive line fluids away from the seating surfaces; assures longer valve life and lowest cost per year.

Made in stainless steel, steel, semi-steel, bronze, monel or other alloys suitable for the working conditions under which they are to be used, Homestead Lever-Seald Valves may be had in sizes from 1" to 12"; and for working pressures from 150 pounds to 1500 pounds.

Choose the sizes and types for your services from Reference Book 39 Section 3. Write for your free copy today.

*Check these Outstanding Features:*

**A QUARTER-TURN** fully opens or closes valve.

**INSTANT STICK-PROOF OPERATION.** Plug turns freely after seating pressure is relieved by screw lever.

**POSITIVE LEAKLESS SEAL** is obtained by applying full seating pressure with screw lever after opening or closing.

**LEAK PROOF.** Deep stuffing box, gland and sealed bottom prevent fluid loss, and reduce hazards.

**STRAIGHT-LINE FLUID FLOW.** Little or no pressure drop.

**SEATING SURFACES ALWAYS PROTECTED** in both open and closed positions. Fluid or grit cannot damage valve seat.



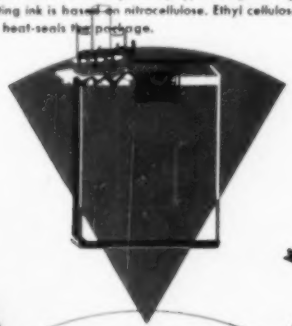

**HOMESTEAD VALVE MANUFACTURING CO.**

P. O. BOX 13 CORAOPOLIS, PENNA.

## Revolutionizing Cigarette Packaging . . .

New packages for cigarettes do away with conventional three or four wraps, seal in freshness, seal out moisture with a single wrap of foil-paper lamination developed by Reynolds Metals Co.

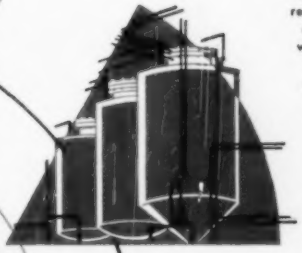
Two Hercules products help make this possible. Nitrocellulose combines with ethyl cellulose to give moisture resistance and durability to the transparent lacquer overcoat. The quick-dry type rotogravure printing ink is based on nitrocellulose. Ethyl cellulose also heat-seals the package.



## Anti-Corrosion Coatings . . .

Corrosion—costliest of all chemical plant maintenance factors—is now being checked successfully with paints based on Hercules Chlorinated Rubber (Parlon®). These finishes have exceptionally high resistance to most acids, alkalies, and salts. They adhere equally well to metal, wood, concrete—even under adverse humidity conditions. They dry overnight.

Parlon-base paints find wide use in textile mills, chemical processing plants, sewage disposal plants, paper mills, and wherever moisture for chemical corrosion present a major problem.






## Low-Cost Shellac Substitute . . .

One of the many money-saving uses for Hercules Vinsol® Resin is as a partial or complete replacement for shellac. Low in price, and available in quantity, Vinsol can readily substitute for shellac in many applications.

Vinsol is a dark-colored thermoplastic resin with a high melting point (234 to 239° F). It is only slightly soluble in most petroleum solvents, but completely soluble in alcohols, ketones, and esters. It is supplied in lumps, flakes, pulverized, or as a stable emulsion.

*Can you profit from these or other Hercules Chemical materials?*

*The products briefly described here are but a small segment of Hercules' broad range of chemical materials for the process industries. Return coupon for technical details or samples of those materials in which you are interested.*

**HERCULES POWDER COMPANY**
952 Market Street, Wilmington 99, Del.

Send technical data ☐ testing sample ☐ of

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TO KEEP structural steel walls and ceilings free from attack by corrosive fumes and gases — paint them with TYGON PAINT.

This chemically inert plastic goes on like paint, air dries quickly, forms a tough, durable, "live" plastic film that provides continuing protection against corrosion long after the failure point of the best oil-base paints.

Tygon Paint will handle effectively the fumes and gases of almost all acids and alkalies, and at temperatures as high as 190°-200° F. It will not oxidize; neither will it crack, craze, check or "alligator."

And with Tygon Paint you're not limited to dull blacks, drab greens or grays. Tygon Paint is available in a wide range of sparkling clean colors, including white.

*Write today for a free test panel of Tygon Paint. Hang it in your plant where corrosive fumes are worst. Stack its performance against any competitive coating. We think you, like thousands of others, will standardize on* TYGON. *Address your requests to Plastics and Synthetics Division, The U. S. Stoneware Co., Akron 9, Ohio.*

**U. S. STONEWARE**

*Since 1865 • Akron 9, Ohio*

**SPECIALISTS IN REDUCING PLANT MAINTENANCE COSTS THROUGH MORE EFFECTIVE MEANS OF CORROSION CONTROL**

THE
# Chementator
Reg. U. S. Pat. Off.

COMMENTS ON THE NEWS OF CHEMICAL ENGINEERING IN INDUSTRY

Volume 56 MARCH • 1949 Number 3

**Crude oil from New Guinea** comes as the climax of 12 years of geological exploration and development work by Netherlands New Guinea Petroleum Co. Completion of a 30-mi. road and pipeline from the oil fields to Sorong made it possible to start production at 4,000 bbl. a day. And the first shipment of crude oil was made just recently from New Guinea

Netherlands New Guinea Petroleum's terminal is Sorong. Once a tiny missionary settlement, Sorong soon became a roaring industrial base after the first discovery well was drilled at nearby Klamono in 1936. Netherlands New Guinea Petroleum was formed in 1935 by affiliates of Shell, Standard Vacuum, Texas and California Standard. It is 60 percent American-owned, 40 percent Dutch and British.

•

**Fate of German industrial plants** is providing plenty of headaches for ECA. The ECA's Industrial Advisory Committee (the so-called Humphrey Committee) has recommended that 167 German industrial plants be withdrawn from the reparations program, spared from dismantling and kept in Germany. At this, both France and Britain are balking.

Picked from almost 400 plants in western Germany, those the ECA wants kept running include plants that turn out construction equipment, industrial machinery, machine tools, steel and steel products, non-ferrous metals and chemicals.

Reluctantly, the French would agree to spare 117 of the plants, the British a few more, with strong objections to the retention of certain machine-tool, steel and chemical plants. Particularly rankled are the French, who claim that ECA's proposals would make western Germany the third heaviest producer of steel in the world, with an annual capacity of 15.9 million tons.

•

**U.S. chemical know-how for Europe** will be exported as a result of deals just made by Pennsalt International Corp., newly formed international subsidiary of Pennsylvania Salt Manufacturing Co. Pennsalt will supply the design, know-how and operating techniques for producing fluorine and sodium subsilicates to manufacturers in England and France.

Using Pennsalt processes, Imperial Smelting Co., Ltd., of London will make fluorine. From Pennsalt, Imperial will get enough fluorine and anhydrous hydrofluoric acid to take care of its industrial requirements until it can construct its own facilities. The Philadelphia company is also providing the British with an initial unit of electrolytic cells. Societe D'Electro-Chimie et des Aciercies Electriques D'Ugine of Paris will use Pennsalt's new, low-cost, continuous process to produce sodium subsilicates. The subsilicates are detergents used in metal working, textile making and commercial laundering.

Both the State and Commerce Departments, as well as the British and French governments, have full knowledge of Pennsalt's program. Thus is industry responding to President Truman's proposal that the U.S. make its technological savvy available to world neighbors.

•

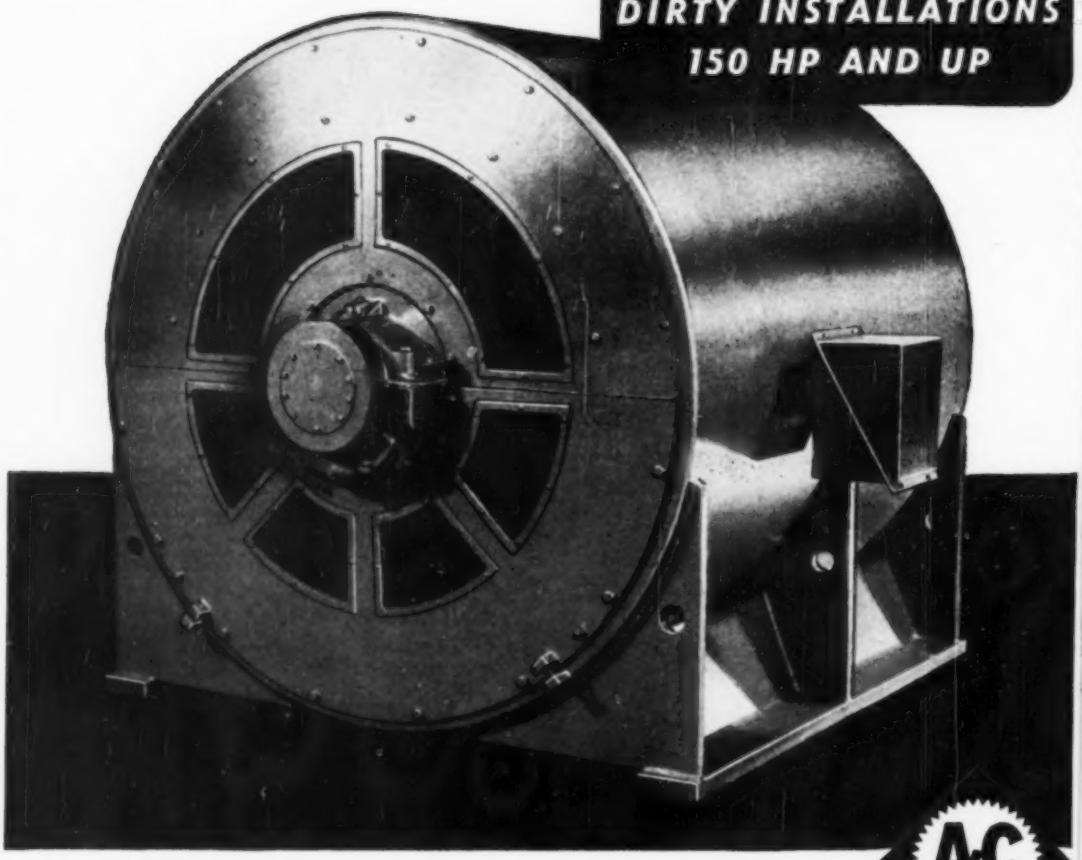
**Professional employees** may lose the privilege of setting up separate bargaining units when new labor legislation is finally enacted. The Taft-Hartley Act specified that NLRB could not recognize a mixed unit of professional and non-professional employees unless the unit was favored by a majority of the professionals. This enabled professional workers in many plants to stay out of the group represented by a union or, if they wanted a union, to set up their own bargaining group with their own union.

Under the Wagner Act, the NLRB often gave scant consideration to the wishes of professional employees when setting up a bargaining unit. Administration supporters in Congress plan to torpedo the

(*Continued on page 74*)

# Totally-Enclosed Motors!

**MAINTENANCE CUT SHARPLY ON OUTDOOR, CORROSIVE AND DIRTY INSTALLATIONS 150 HP AND UP**



A-C ALLIS-CHALMERS

# ALLIS-CHALMERS

A 2613

**Pioneers in Power and Electrical Equipment From Generation Through Utilization**

# New Tube-Type Fan-Cooled

THE NEW ALLIS-CHALMERS tube-type totally-enclosed fan-cooled motor reduces maintenance to a point never before reached in totally-enclosed design.

This saving is made possible by the unique method of cooling. Straight tubes, running parallel to the shaft, surround the stator core. Internal fans circulate air within the motor to transfer heat to the tubes. An external fan moves outside air through the tubes to remove heat quickly and effectively. This heat exchanger is so efficient that the new Allis-Chalmers tube-type motor is only slightly larger than an open motor of the same rating.

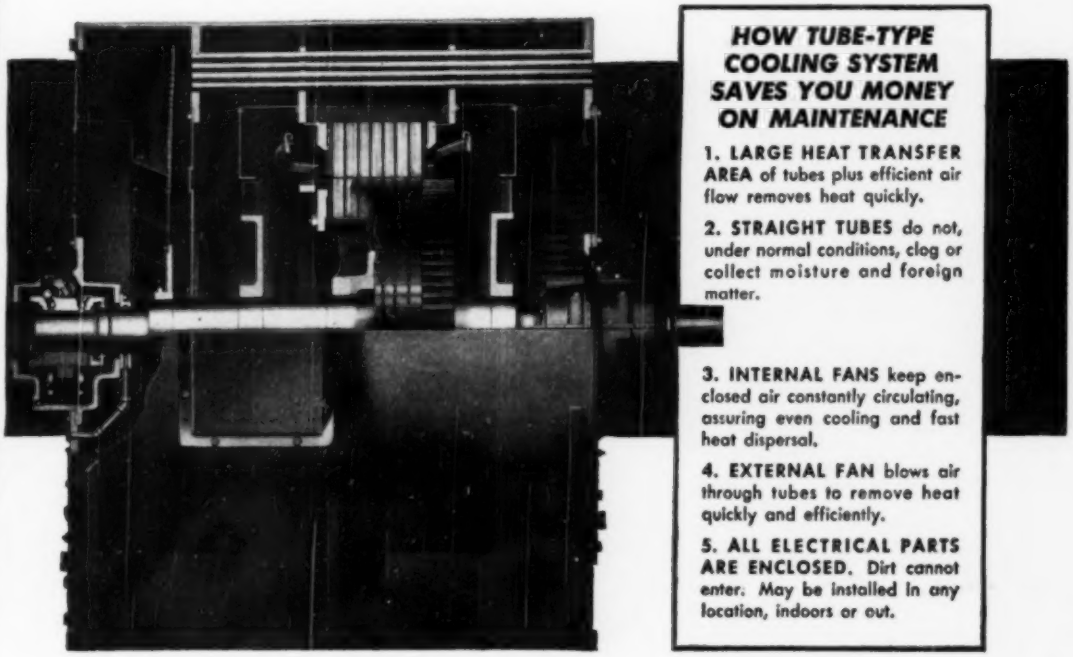
## MAINTENANCE MATERIALLY REDUCED

The new Allis-Chalmers tube-type motor is practically self-cleaning because the tubes are straight, the air passages unrestricted, and the cooling air flows at sufficient speed to carry foreign matter out with it. Should unusually dirty air conditions make cleaning desirable, tubes can be swabbed out quickly and easily. Since all electrical parts are enclosed, this new motor can be installed indoors or out in any atmosphere.

## COOLING EFFICIENCY PROVED

Three years of successful operation in the field have proved that the new Allis-Chalmers tube-type, totally-enclosed, fan-cooled motor can bring important savings to any industry faced with high motor maintenance costs due to dirty, corrosive or hazardous operating conditions. For information on this new motor contact your nearest A-C district office or write for bulletins 05B7150 and 51R7149.

ALLIS-CHALMERS, 1147A SO. 70 ST.
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### *HOW TUBE-TYPE COOLING SYSTEM SAVES YOU MONEY ON MAINTENANCE*

**1. LARGE HEAT TRANSFER AREA** of tubes plus efficient air flow removes heat quickly.

**2. STRAIGHT TUBES** do not, under normal conditions, clog or collect moisture and foreign matter.

**3. INTERNAL FANS** keep enclosed air constantly circulating, assuring even cooling and fast heat dispersal.

**4. EXTERNAL FAN** blows air through tubes to remove heat quickly and efficiently.

**5. ALL ELECTRICAL PARTS ARE ENCLOSED.** Dirt cannot enter. May be installed in any location, indoors or out.

(*Continued from page 71*)

Taft-Hartley Act, and to reenact the Wagner Act with amendments covering secondary boycotts, jurisdictional strikes, arbitration of disputes over contract interpretation, non-Communist affidavits and national emergency strikes. Consideration for professional employees will probably get lost in the shuffle.

•

**Compulsory "overtime on overtime"** may be killed by an amendment to the Wage-Hour Law. Both labor and management are behind the measure, which may be the first labor legislation to come out of the 81st Congress.

The bill under consideration would exclude from the "regular rate" of pay, and apply against any overtime due under the law, most of the time-and-a-half premium payments now made by industry for night work, holidays and week-ends. It would also exclude from the base wage, on which time and a half must be paid after 40 hr. a week, payments which employers make into employee welfare funds and for other "fringe" benefits.

The proposed revision is particularly important to the management of chemical plants running on continuous shifts. If you pay time and a half for Saturday or Sunday or holidays, or for night work, you could charge the extra payment against any overtime due under the law. Moreover, you would not have to figure it in your "regular rate" and pay time and a half on top of that.

•

**Fight for a new election** at Du Pont's plant in Belle, W. Va., has been lost by the CIO Chemical Workers. The union lost the election last summer by a close vote, 1,551 for the union and 1,616 against it. The United Mine Workers, District 50, which had held bargaining rights, could not get on the ballot because of failure to file non-Communist affidavits. With the CIO Chemical Workers defeated in the election and District 50 squeezed off the ballot, NLRB certified that the employees had decided not to be represented by a union.

NLRB recently dismissed objections to the election filed by the CIO union and certified the results. The CIO Chemical Workers had protested that: (1) the employees were influenced against the CIO because Du Pont signed a contract with District 50 in December 1947, a week after the CIO filed its election petition; and (2) District 50 leaders in the plant were allowed to campaign for a "no union" vote. In dismissing the objections, NLRB pointed out that the CIO union did not protest against the District 50 contract until after the election and that Du Pont attempted to stop District 50 campaign activities in the plant against the CIO.

Another election at Belle will probably be sought this summer. Will District 50 be able to participate? That will depend on whether the new labor law retains the non-Communist affidavit rule.

•

**Cleaning out of Communists** goes on apace in the American Federation of Labor. One day last January AFL President William Green spoke at the dedication of the new sound-proofed and air-conditioned headquarters building of the International Chemical Workers at Akron. One of Green's major points: "There is no place in the house of the American Federation of Labor for Communists."

The next day, the U.S. Immigration Service said at Buffalo that there is no place in the United States for one of the directors of the International Chemical Workers – William Edmiston of Toronto. An Immigration officer explained that Edmiston was permanently banned from this country, that his assistant and two organizers were temporarily barred. All are Canadians. The Immigration Office's only explanation: it had acted under a law which permits exclusion of "any person whose presence in the United States would be deemed to be prejudicial to the best interests of the country."

The AFL has split with the Communist-dominated Canadian Trades & Labor Congress, with which its Canadian branches are affiliated. The AFL executive council, meeting in Miami, said it would not compromise with the Communists, who forced suspension of the AFL Railway Clerks from the Canadian labor organization for supporting the anti-Communist AFL Seafarers in a fight with the Communist-dominated Seamen's Union.

•

**Peaceful strikes are poison** to the Communists. When 1,400 AFL workers struck for higher wages at Carbide & Carbon's Texas City plant in February, the New York Communist newspaper, *The Daily Worker*, took particular interest in the strike.

"The importance of this struggle is that it will largely determine the pattern of wages for all the chemical plants along the Gulf Coast," the *Daily Worker* correspondent wrote.

But he was critical of how the strike was being conducted. Strike leaders had not "developed a militant, fighting setup." They had not organized strike relief. The CIO, which had recently lost an election at the



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**Little Johnny's trip to the woodshed** proves an important point of business economics—that good distribution in the right place at the right time gets results. With industrial chemicals it means ability to serve your customers faster, smoother, more economically.

To do this, General Chemical has concentrated more than 90 producing and distributing facilities in America's centers of commerce. Here is a vast supply line of basic industrial chemicals from coast to coast. For 50 years it has supplied America's leaders; draw upon it for your needs, too.

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REAGENTS
FINE & SPECIAL CHEMICALS

plant, was not supporting the strike. Worst of all, he found, no effort was being made to organize community support behind the strike.

•

**Leases on phosphate deposits in the West** are to be governed by new rules. The Interior Department has approved new regulations for the exploration of phosphate deposits on government lands and for their commercial exploitation.

The new rules permit leasing of these public lands for phosphate operations under provisions stipulating continuity of industry's participation in the program. There will be non-competitive leases to promote discovery of deposits and competitive leases for development and production at known deposits. Rents and royalties would be paid out of resulting production.

You can lease a maximum of 5,120 acres. While they have no termination date, the leases would be subject to revision at the end of 20 years. The rules also forbid one lessor to hold more than 10,240 acres in the U.S. at any one time. This and the 5,120-acre limit are to preclude monopolies.

•

**A synthetic fuels industry** is the goal of bills now in the legislative hopper on Capitol Hill. Two bills (H.R. 566 and S. 6) have been introduced which would authorize loans to industry for the construction of commercial plants to produce oil and gasoline from coal and oil shale.

Interior Secretary Krug in his annual report stresses the need for such legislation. The danger that Krug foresees: the U.S. will depend solely upon petroleum until the supply problem becomes critical. And Krug warns that it would take five or ten years to develop significant production of synthetic fuels.

The annual report attempts to dispel the bugaboo of high production costs. It points out that in a hydrogenation plant turning out 30,000 bbl. a day the gasoline production costs could be trimmed to as little as 4c. a gal. by utilization of such by-products as liquefied petroleum gas and phenol. It also points to the achievement of the Bureau of Mines in cutting direct mining costs for oil shale down to 50c. a ton.

•

**Gasification of coal underground** is coming in for renewed attention. The U.S. Bureau of Mines has resumed its tests on land of the Alabama Power Co. near Gadsden. Gasification of coal in place in the mine is now under way. The bed fired two years ago was too close to the surface. As a result, it was difficult to control products generated during firing. But this time Bureau engineers have blocked off with concrete walls a much deeper section of the coal bed. The present experiments, therefore, should give better yield data on products recovered by underground gasification.

Also experimenting with underground gasification of coal is Carbide & Carbon Chemicals Corp. at a spot about 15 mi. up the river from its South Charleston, W. Va., plant. Carbide has purchased rights to the coal under about 30,000 acres in central West Virginia. And Carbide is also working on coal hydrogenation.

What has Carbide up its sleeve? If Carbide finds a way to hydrogenate coal clear down to the $C_2$-$C_4$ range, instead of stopping at a gasoline range, it will have a ready source of hydrocarbon raw materials to supplement those it gets from refinery gases and natural gas. But this will gobble up hydrogen. If Carbide gasifies coal underground, gets CO and $H_2$ and then uses the water gas reaction, it can get the pure hydrogen needed in large volume.

•

**Cellophane production capacity** is to be upped by American Viscose. When American Viscose has doubled the capacity of its Fredericksburg, Va., plant in about two years, total output from all Viscose plants will reach 100 million pounds of cellophane a year. Currently, over-all production of cellophane is about 220 million pounds yearly, with Du Pont making 75 percent and Viscose the rest. After its expansion at Fredericksburg, American Viscose hopes to produce about 40 percent of the total.

•

**Acquisition of Southern Acid & Sulphur** further diversifies Mathieson's line of basic chemicals. Mathieson has purchased Southern Acid & Sulphur and is distributing 265,000 shares of authorized but unissued Mathieson common to common stockholders of Southern Acid & Sulphur. To finance the expansion, an increase in Mathieson's common from 1,000,000 to 1,500,000 has been authorized by the stockholders. Mathieson is also negotiating for the purchase of Standard Wholesale Phosphate & Acid Works of Baltimore.

Southern Acid & Sulphur is a $6 million sulphur and phosphate outfit with plants in Texas, Louisiana and Arkansas. Its net sales in 1948 were $21,800,000 and net profit $2,620,000. Mathieson's negotiations for the purchase of Standard Wholesale Phosphate

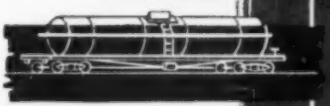
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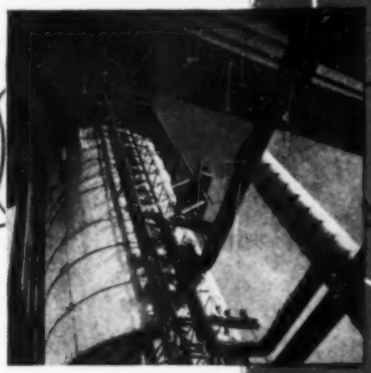
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SYNTHOL CHEMICALS



Wide experience combined with highly specialized knowledge is the important factor in the design of successful distillation units.

We have designed, engineered and constructed commercial distillation units of all sizes for the petroleum and chemical industries — from capacities of 6 barrels per day of peppermint oil to 90,000 barrels per day of petroleum crude distillation.

This broad experience is available for the solution of new problems or improved approaches to old.

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PROCESS ENGINEERS AND CONSTRUCTORS FOR THE CHEMICAL, PETROLEUM AND PETRO-CHEMICAL INDUSTRIES

& Acid Works, also a major producer of sulphuric acid and phosphate fertilizers, are nearing completion.

Acquisition of Southern Acid & Sulphur puts Mathieson in the business of manufacturing sulphur, sulphuric acid, ammonium sulphate, phosphoric acid, ammonium phosphate, superphosphates and mixed fertilizers. Previously, Mathieson's chief products have been caustic soda, soda ash, chlorine, salt cake and ammonia. In 1948 Mathieson shelled out $19 million to increase capacity at its Louisiana and Niagara Falls plants.

•

**A big new Teflon plant for Du Pont,** at Parkersburg, W. Va., just authorized, will be producing in two or three years, if work starts this year. Meantime, Du Pont engineers are hard at work on new techniques for fabricating the polymer. Teflon is notoriously hard to handle, since it does not melt. Being kept under blankets are radically new techniques that have already yielded results. Cheap extrusion of sheeting in relatively heavy gages has already been achieved. More important to chemical engineers, however, are methods of lining steel equipment. Previously, no cement was known, and the polymer would not stick to anything. This problem has been licked. Now it is going to be possible to coat or line most metal equipment with thin or heavy coats of Teflon.

•

**Nonyl alcohol production** by the Oxo process had been planned by Indiana Standard for early this year. High-pressure equipment at Indiana Standard's Whiting refinery was to be revamped for production of this nine-carbon alcohol (see *Chementator,* Nov. 1948, p. 80). But now there has been a change in plans. Due to high construction costs, Indiana Standard has shelved its plans for production of nonyl alcohol by the Oxo process.

•

**Du Pont's neoprene production** is to be concentrated at its Louisville, Ky., plant. Du Pont is shutting down its neoprene plant at Deepwater, N. J. Henceforth, total output of neoprene will come from the war plant at Louisville, recently purchased by Du Pont.

•

**Recovery of heat and sulphur dioxide** from sulphite blowpit gases is the latest operating economy wrinkle employed by engineers at the Everett, Wash., mill of Soundview Pulp Co. The method does three things: (1) pares estimated cost of producing pulp by almost $1 a ton; (2) saves timber by providing steam that otherwise would be generated by burning wood; (3) eliminates discharge of $SO_2$ into the atmosphere. The installation is the largest of its kind on this continent.

The process has five steps: (1) steam in the digester blow gases goes through a concurrent-flow condenser and the condensate collects in a hot water accumulator; (2) condensate heat recovered in a spiral heat exchanger is used in the plant, while the cooled water returns to the condenser; (3) condenser gases are cooled; (4) $SO_2$ in the condenser gases is absorbed by water in a packed countercurrent absorption tower; and (5) $SO_2$ solution is collected and used as makeup in the Jenssen acid towers.

About 950 lb. of steam at 225 psi. and 40 deg. F. is recovered for each ton of air-dry bleached sulphite pulp made; this is about 75 percent of the total available heat. Recovery of sulphur as $SO_2$ is about 40 lb. per ton of bleached pulp or about 80 percent of the sulphur available in the blowpit gases. Net result of $SO_2$ recovery and absorption: capacity of the digest acid plant has been upped close to 15 percent.

•

**Price rises of major plastics** over the last three years have lagged far behind advances in other structural materials. A few have even declined in price. Steel has advanced 44.4 percent, aluminum 88.9 percent, lead 258 percent and lumber about 100 percent since December 1945. Meantime, general-purpose phenolic resins are up 20.6 percent, freight included; vinyl resins, up 3.3 percent, freight included; polyethylene, down 17 percent; polystyrene, 6 percent higher; urea resins, 12.7 percent more; flake cellulose acetate, up 27 percent; and ethyl cellulose, 11.5 percent higher.

•

**Sterilizer for ion exchange beds** will soon be brought out by Wallace & Tiernan. Growth of bacteria on ion exchange beds has been a real problem in the food and drug industries. Chloromelamine will be used to sterilize the ion exchange beds. This chemical oxidizes the bed enough to rid it of bacteria, but there is not enough chlorine to react with the resin.

•

**New uses for fluorine compounds** keep cropping up. Fluorine derivatives enter into the manufacture of high-octane gasoline, fluorine plastics that resist chemical attack and other products of the atomic age. Now fluorine compounds are being tested as high-temperature greases, lubricants for jet aircraft and hydraulic fluids for aircraft. Other fluorine derivatives are used as heat transfer media, ingredients in insecticides and high-boiling inert solvents.




# Now Pittsburgh Iminol-D

## stabilizes 2,4-D Amine Solutions and prevents hard water precipitates

The effective use of concentrated 2,4-D amine solutions for weed control has been made difficult, and sometimes impossible, in many agricultural regions because of *hard water* conditions. But *now* the precipitation of undesirable salts (caused by the dilution of concentrated 2,4-D amine solutions with "hard" water) can be avoided.

A new *Pittsburgh* chemical . . . IMINOL-D . . . when incorporated in 2,4-D concentrates at the time of formulation, not only prevents nozzle-clogging precipitates but also increases the wettability and effectiveness of the spray. Precipitation protection lasts for an adequate period after hard water dilution.

Since many of the richest agricultural areas in the country have water classified as hard or very hard, the introduction of Pittsburgh IMINOL-D is a development of significant importance to herbicidal spray manufacturers.

Full technical information is available in bulletin form. Write for *Pittsburgh* IMINOL-D Bulletin today!

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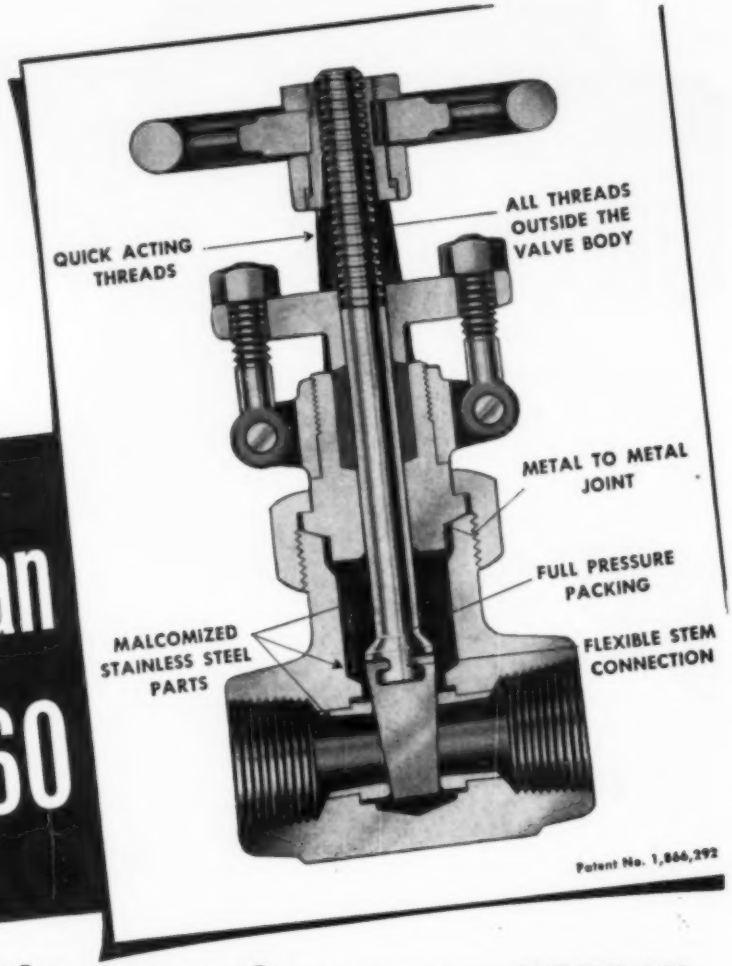
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**Parathion**
**Para Amino Phenyl Mercuric Acetate**
**Phenol**
**Phthalic Anhydride**
**Picoline—Alpha, Beta and Gamma**
**Pipe Line Enamel**
**Pyridine—Medicinal and Industrial**
**Sodium Cyanide**
**Sodium Thiocyanate**
**Sulphate of Ammonia**
**Sulphuric Acid—60°, 66° and Oleum**
**Tar Acid Oil Disinfectants**
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**Xylol—10°, 5° and 3°**

COAL CHEMICALS, ACTIVATED CARBON, NEVILLE COKE, EMERALD COAL, PIG IRON, GREEN BAG CEMENT, CONCRETE PIPE AND PRODUCTS

# Chapman List 960



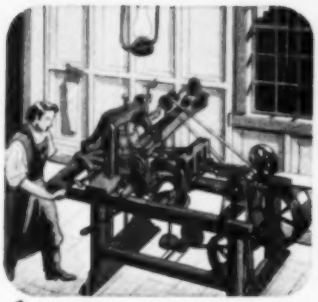

## —the gate valve you can REPACK under FULL PRESSURE




This Chapman List 960 was specifically designed to simplify your maintenance problems. For instance, you can repack it without interrupting service . . . there's no pressure transmitted to the stem. And you can use it inside or out, for a forged steel packing gland protects vital yoke threads from rust and corrosion. To ensure longer wear, seats and plugs are made of superhardened stainless steel . . . body and yoke of tough forged steel.

*For your best buy* . . . specify the Chapman List 960. Available in sizes from ¼" to 2" . . . carbon steel for pressures to 800 pounds; alloy steel for pressures to 1000 pounds at 750°F. For higher pressures, specify List 990.

**The Chapman Valve Mfg. Co.**
INDIAN ORCHARD, MASSACHUSETTS



**1** **1885**—Here's how machines looked before man applied electricity for industrial usage. Gear setups were crude. Making parts fit was a matter of luck and plenty of tinkering by operators.



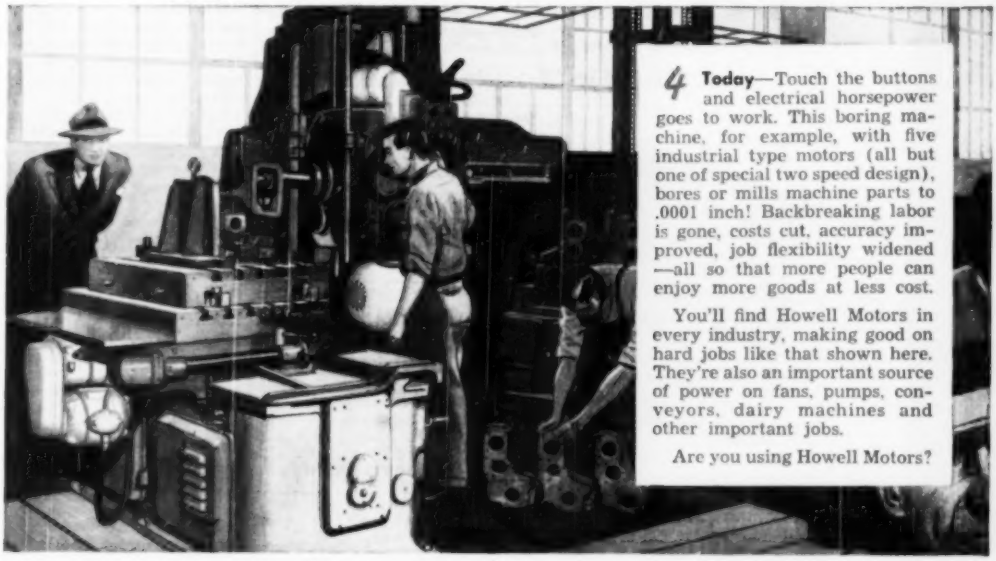
**2** **1907**—Electrical horsepower gave production a big boost. But gear mechanisms were far too cumbersome. Repairs were frequent. Men were still struggling to make one motor do the work of many . . .



**3** **1915**—Howell "Red Band" Electric Motors arrived. These rugged, industrial type motors were specially designed to withstand hard usage. Soon, Howell Motors appeared in this and other industries.

# NOW, IT'S TOUCH AND GO!

**(and parts are machined quicker and to closer tolerances)**



**4** **Today**—Touch the buttons and electrical horsepower goes to work. This boring machine, for example, with five industrial type motors (all but one of special two speed design), bores or mills machine parts to .0001 inch! Backbreaking labor is gone, costs cut, accuracy improved, job flexibility widened—all so that more people can enjoy more goods at less cost.

You'll find Howell Motors in every industry, making good on hard jobs like that shown here. They're also an important source of power on fans, pumps, conveyors, dairy machines and other important jobs.

Are you using Howell Motors?

*Free enterprise encourages mass production, supplies more jobs—provides more goods for more people at less cost.*

**Here's** another precision-built Howell Motor . . . industrial type with copper or bronze bar rotors . . . specially insulated . . . statically and dynamically balanced.



**Howell Enclosed, Fan-Cooled Motor—Type K**

## HOWELL MOTORS

**HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.**

***Manufacturers of Quality Industrial Type Motors Since 1915***

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## New treatise on

# PLASTICIZERS

## now available to industrial users

As a service to industrial users of plasticizers, Monsanto has published a new 80-page treatise entitled "Monsanto Plasticizers." It is a comprehensive discussion of plasticizing action and the performance results of Monsanto plasticizers.

Liberally illustrated and containing many interesting charts, "Monsanto Plasticizers" is available to help industry in choosing—and using—the right plasticizer. To obtain a copy, write on your company letterhead, or return the coupon.

### Subjects Covered in "Monsanto Plasticizers"




- How a Plasticizer Works
- Evaluating Plasticizers
- Monsanto Plasticizers
- Compatibility
- Performance:
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  - Volatility
  - Water Resistance
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- Technical Service

# ORTHODICHLOROBENZENE

**Low-flammability cleaning solvent recommended for use in garages, machine shops, die works, tool rooms**

A versatile solvent, orthodichlorobenzene has the unusual advantage of combining high solvent power and low toxicity with low flammability. In recent tests, rags soaked in the chemical would barely support combustion when exposed to flame—snuffed out when flame was removed. Blends of gasoline or kerosene and orthodichlorobenzene are relatively nonhazardous cleaning agents for machine shops, die works, garages and tool rooms. It is also recommended as a paintbrush cleaner and "spotting" agent.

**Now available in convenient 5-gal. packages**

As a service to small-volume consumers, Monsanto is now packaging orthodichlorobenzene in quantities as small as five gallons . . . For information on its many uses, send for a copy of the booklet, "Monsanto Orthodichlorobenzene."



# TEAMWORK SOLVES AVIATION PROBLEM

Fluid for airplane hydraulic systems was a complicated problem until Monsanto chemists and Douglas Aircraft engineers combined their research efforts. The result of this teamwork: SKYDROL . . . a non-flammable pressure-transfer medium that gives *extra* performance . . . *extra* economy . . . *extra* safety.

Skydrol is a superior hydraulic fluid. It has been proved in the laboratory and has given excellent results in service. It does not burn . . . does not corrode hydraulic system metals . . . is non-toxic. It is stable to heat, pressure and altitude . . . does not thicken nor lose film strength, volume or viscosity in long service. Skydrol also serves as a superior lubricant, keeping pump parts in good condition twice as long as do ordinary petroleum hydrocarbon fluids. Skydrol's properties indicate that its uses may be extended to numerous industrial pressure-transfer applications.

If you build, operate or service airplanes, it will pay you to investigate Skydrol . . . It may also be worth your while to try Skydrol for other industrial uses. Data and samples sent promptly upon request.

### HOW CAN YOU USE THESE?

**ortho-NITROCHLOROBENZENE**

**BENZYL CHLORIDE**

Now available in quantity from Monsanto, these chemicals have wide possibilities in addition to their many established uses. Write for specifications and samples.

# NOW READY FOR TEXTILE MILLS

**Sterox 5 and 6 are Non-ionic Type Detergents and Wetting Agents—Economical, but High in Efficiency**

Sterox* No. 5 and Sterox No. 6, two highly efficient, non-ionic detergents and wetting agents, are now available to the textile and dyeing industries in quantity and at favorable prices.

These clear, amber-colored detergents and wetting agents are polyoxyethylene thioethers which contain no alkali. They can be compounded with other non-ionic, an-ionic and cat-ionic surface active agents, improving many of the properties of materials to which they are added. Stable over wide ranges of pH and heat, the Steroxes are efficient in solutions that are hot or cold, hard or soft, acid or alkaline. In addition to being effective detergents and wetting agents, Sterox No. 5 and Sterox No. 6 are excellent for dispersion and emulsification.

Supplied in highly concentrated form, without builder salts, it is seldom necessary to use Sterox No. 5 or Sterox No. 6 in concentrations of more than 0.05%. This and the favorable prices make the Monsanto Steroxes economical to use. Being liquids, they are easier to apply with accuracy.

**TEXTILE MANUFACTURE . . .** Sterox No. 6 is a rapid wetter and is efficient and economical in any operation that requires a detergent or wetting agent. It is exceptionally good for scouring woolen skeins and piece goods. It is effective as a rewetting agent in Sanforizing and, left as a residue, it makes new towels more absorbent.

**DYEING PROCESSES . . .** Steroxes can be used with great success in dyeing and scouring operations. Being non-ionic, they are compatible with any type of dye bath used. Because of their penetrating ability, the Steroxes speed up dyeing operations and yield thorough, even color.

**DATA AND SAMPLES . . .** Data and samples of Sterox No. 5 and Sterox No. 6 will be sent upon request. Use the coupon, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Phosphate Division, at address shown on coupon.

# AROCLORS

**More protection in modified and synthetic rubber coatings**

**(Technical Bulletins Available)**

Monsanto AROCLORS (chlorinated biphenyl and chlorinated polyphenyls), used as plasticizers or resins for modified and synthetic rubber coatings, such as Parlon and Pliolite, add qualities that give extra durability. In coatings for concrete, metal and wood surfaces, and for uses requiring good electrical insulating properties, AROCLORS provide the following:

1. Greater toughness and adhesion.
2. Stronger resistance to corrosion, flame, water and weather . . . to acids and alkalies.

There is a series of Monsanto AROCLORS, liquids and resins, with special properties designed to meet specific requirements for a wide variety of industrial applications. For full information, send for copies of technical bulletins listed below.

**Literature on Monsanto AROCLORS**

"The AROCLORS"—Application Data Bulletin No. P-115.

"AROCLORS as Used in Chlorinated Rubber"—Technical Bulletin No. P-124.

"AROCLORS as Used in Pliolite S-5"—Technical Bulletin No. P-126.

"AROCLOR Incombustible Lubricants Used in High-Pressure Compressors"—Technical Bulletin No. P-128.

"AROCLORS as Co-Plasticizers for Polyvinylchloride"—Technical Bulletin No. P-131.

"AROCLORS as Used to Extend or Substitute Carnauba Wax"—Technical Bulletin No. P-132.

"AROCLOR 1254, Co-Plasticizer with DOP for Vinyl Organosols and Pastes"—Technical Bulletin No. P-134.

*AROCLOR: Reg. U. S. Pat. Off.*



Milmer 1-treated



Untreated

**TROPICAL EXPOSURE TESTS PROVE PERMANENCE OF MILMER 1**

**Exceptional fungicide for canvas**

Extensive tests at Harbel, Liberia, have demonstrated the unusual permanence of Milmer* 1 (Monsanto's Copper 8-Quinolinolate-T) as a fungicide for canvas goods, plastic-coated fabrics and awning striping paints. Subjected to the most adverse weathering conditions, Milmer 1-treated materials lost little of their tensile strength even when exposed for as long as six months. Untreated samples deteriorated almost completely.

In addition to its rot and mildew-resistant qualities, Milmer 1 is also characterized by extremely low toxicity to higher animals . . . Patch tests on 200 individuals show that the chemical is neither a skin irritant nor sensitizer.

Full data and samples of Milmer 1 will be sent promptly on request. It is recommended particularly for applications where color is not a primary consideration. *Reg. U. S. Pat. Off.

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*with*

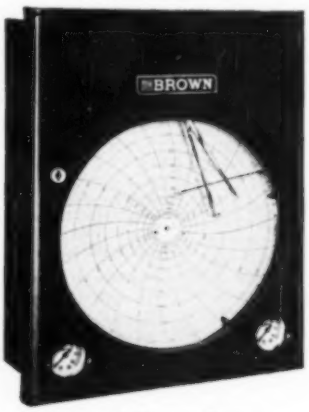
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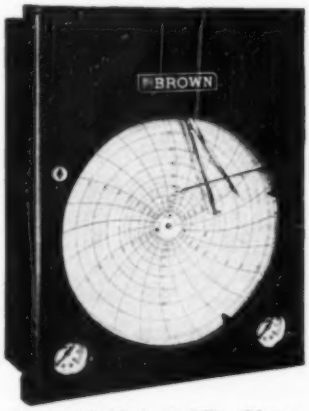
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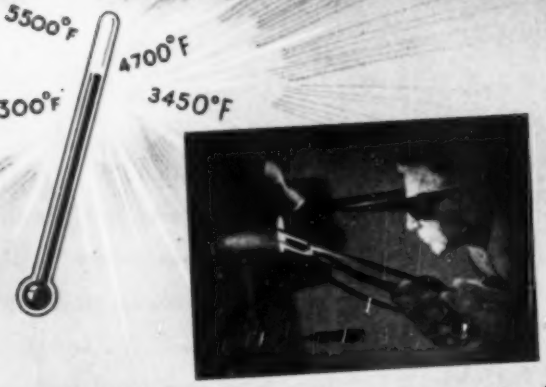
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**Industry Uses These Temperatures Today . . . with Norton-Developed Refractories**

TEMPERATURES as high as 4300° F. for sintering carbides . . . up to 4700° F. in the manufacture of acetylene . . . even up to 5500° F. in certain research projects . . . that's the trend in industry today, toward higher and higher temperatures.

High temperatures call for special refractories in which Norton Company has been pioneering for 36 years. As in many industries, the process industry also is turning to Norton for special refractories to handle today's super temperatures. Outstanding in high temperature operations are Norton's pure oxide refractories of thoria, zirconia, fused magnesia (MAGNORITE*) and fused alumina (ALUNDUM*).

In addition to handling super temperatures in process plants, Norton refractories are handling heat for many industries—metal; ceramic; power and gas generating.

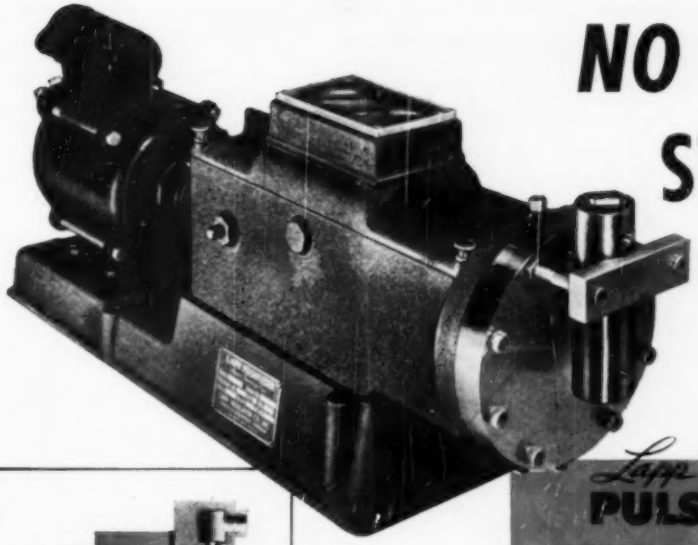
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The main Worcester plant of Norton Company

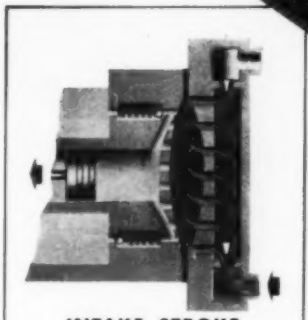
NORTON REFRACTORIES LIKE HEAT

**NORTON COMPANY, WORCESTER 6, MASS.**

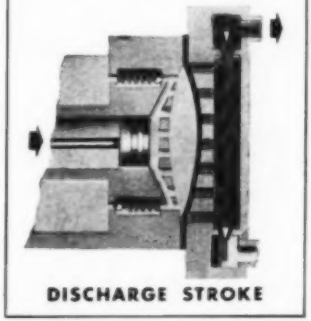


# NO STUFFING BOX

Lapp
**PULSAFEEDER**
PISTON-DIAPHRAGM PROPORTIONING PUMP



INTAKE STROKE



DISCHARGE STROKE

● Operation of the Lapp Pulsafeeder depends on no mechanical or liquid seal; no packing or other "leak-likely" gland can be in contact with liquid being handled. Instead, a hydraulically-balanced diaphragm acts as a floating partition, without mechanical load or pressure differential across it. This assures complete isolation of chemicals being pumped from all working pump parts.

HYDRAULICALLY-BALANCED DIAPHRAGM, made from the most suitable of several available materials, is confined by machined "dishes" within its fatigue limit, secure against failure.

CHEMICAL ISOLATED by diaphragm from working parts of pump.

MICRO-ADJUSTABLE to any rate of flow by calibrated handwheel, *while pump is in operation.*

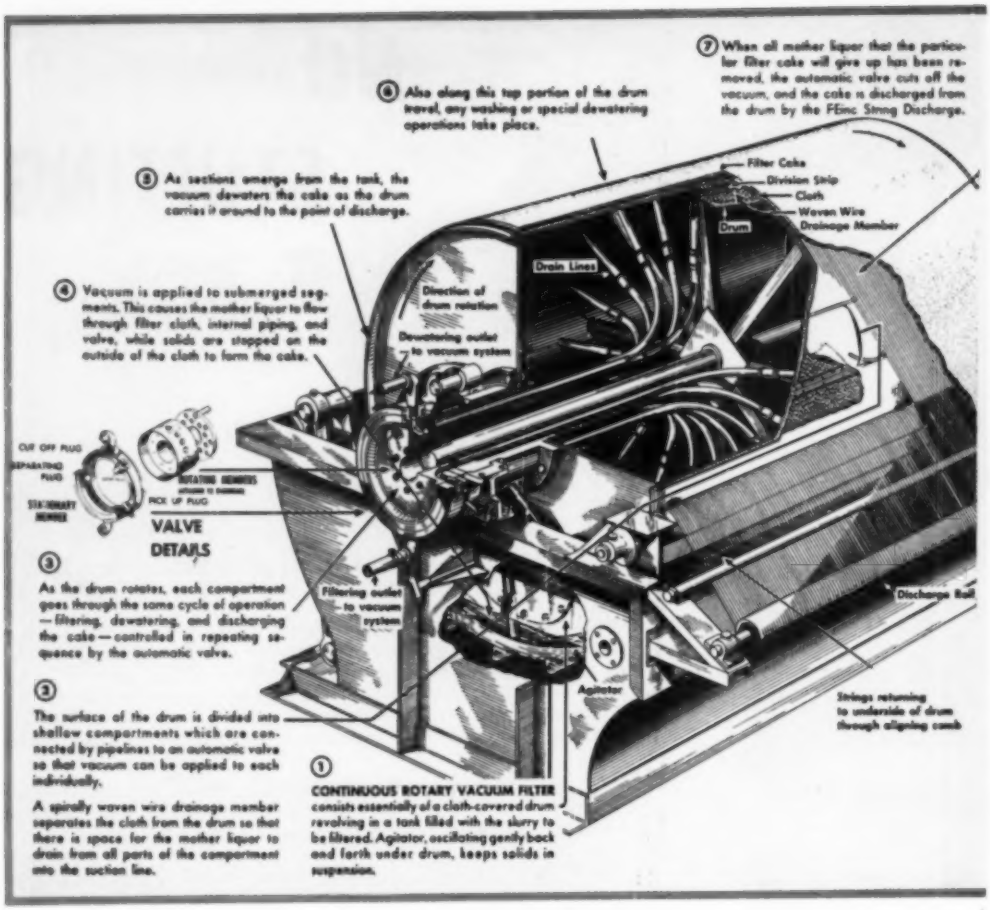
PERFECT LUBRICATION—all moving parts submerged in oil bath.

CAPACITY ranges from less than 100 ml. per hour to 660 gallons per hour; pressures up to 2250 psig. Single head and duplex models are available in a range of four sizes.

SEND FOR BULLETIN No. 262 which carries complete description and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 145 Maple St., Le Roy, N. Y.

**Lapp** *Process Equipment*

CHEMICAL PORCELAIN VALVES
PIPE • RASCHIG RINGS
PULSAFEEDER PROPORTIONING PUMPS




# HOW THE FEinc GETS ITS

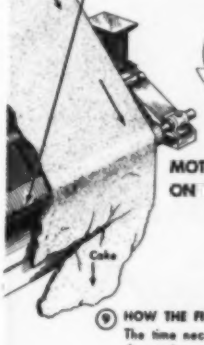
**Here's the inside story of the famous FEinc Filter with the String Discharge that lifts the cake in one continuous sheet. No filtrate is blown back into the cake by compressed air—and there's no scraper to smear the cake into the cloth. This exclusive FEinc feature increases life of filter cloths, and permits use of lighter, more efficient fabrics. Cloth changes are faster, too, for there's no wire winding, and the strings actually help apply the new cloth.**

**Other features which can be added include the FEinc washing mechanism for cleaner cakes and higher recovery of solubles, and the FEinc compression dewatering mechanism that gets cakes 2% to 6% drier. Details in Bulletin 101 —why not look into it?**




**① STRING DISCHARGE:**
Endless strings spaced about ½" apart pass around the drum. The cake is built up over these strings so that, as they leave the drum, the cake is lifted away from the cloth by the strings.

The strings then pass around the discharge roll. At this point the cake is freed from the strings. The strings are then led back over another roll to the under side of the drum.



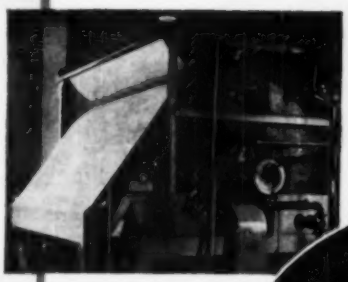




**MOTOR DRIVES LOCATED ON THIS END OF FILTER**

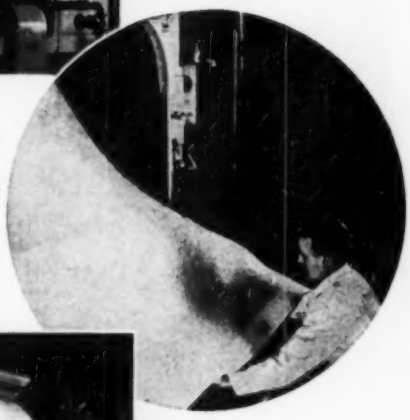
**② HOW THE FILTERING IS CONTROLLED:**
The time necessary for filtering and for dewatering vary with the particular slurry. In designing the filter, these needs are filled by proper balance between:

—Degree of submergence of drum
—Speed of rotation of drum
—Vacuum
—Selection of filter medium



*Ceramics*

FEinc Filter with String Discharge in ceramic industry.



*Penicillin*

This FEinc chemical washing filter is totally inclosed for sterilization. Used throughout the penicillin industry.



*Soy Beans*

Chemical washing filter delivering clean, firm cake of soybean protein. This filter includes FEinc compression mechanism.

# ROTARY VACUUM FILTER
# HIGH EFFICIENCY




**FILTRATION ENGINEERS INC.**

155 Oraton Street Newark 4, N. J.

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**Send for free Bulletin 101**



# STURTEVANT *Whirlwind* AIR SEPARATORS

## CUT PRODUCTION TIME AND COSTS

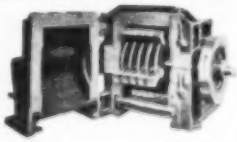
- **Increase production of Fines up to 300%**
- **Capacities from ¼ to 50 Tons per hour**
- **Finenesses from 40 to 325 mesh and finer**

Large or small plants can increase output of accurately sized dry materials and cut costs, too, with Sturtevant Whirlwind Air Separators.

These highly efficient separators select a continuously uniform product of any desired fineness from 40 to 325 mesh and finer. Used in combination with mills, they will increase production by as much as 300% . . . cut power costs up to 50%.

Large feed opening, rugged construction, ease of adjustment, low power consumption assure economy of operation and minimum upkeep. Write for Bulletin 087 today.

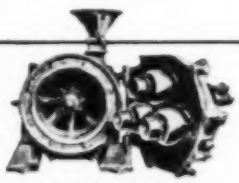
**STURTEVANT MILL CO.**
**100 CLAYTON STREET, BOSTON 22, MASS.**



SWING-SLEDGE MILLS for coarse and medium reduction (1" to 20 mesh.) Open door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.



ROTARY FINE CRUSHERS for intermediate and fine reduction. (1" to ¼"). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers. Many sizes.



RING ROLL MILLS for medium and fine reduction (10 to 200 mesh) hard or soft materials. Operate in closed circuit with Screen or Air Separator. Open door accessibility. No scrapers, plows, or shields.

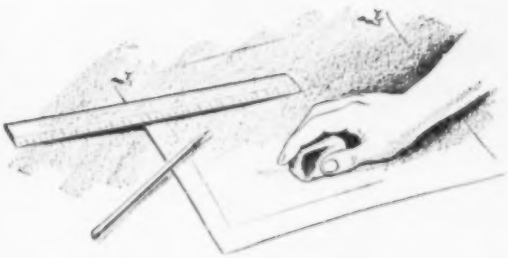


MOTO-VIBRO SCREENS screen anything screenable. Classified vibrations. Unit construction—any capacity. Open door accessibility. Open and closed models with or without feeders. Many types and sizes—½" to 60 mesh.

an ƒ "reason why"



## removes as easy as an eraser



An eraser is easy to use.
It removes something no longer desired. . .
Simply and effectively!

An ƒ Fume Scrubber is just as easy to use. . .
Operates simply and effectively. . .
In removing objectionable vapors and dusts.
It employs jet action of water. . .
To produce draft. . .
For entrainment of gases. . .
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ƒ Fume Scrubbers are available. . .
In Steel, Cast Iron, Haveg, Stoneware, . . .
For most any process application.
They often pay for themselves. . .
In the salvage of recovered components.

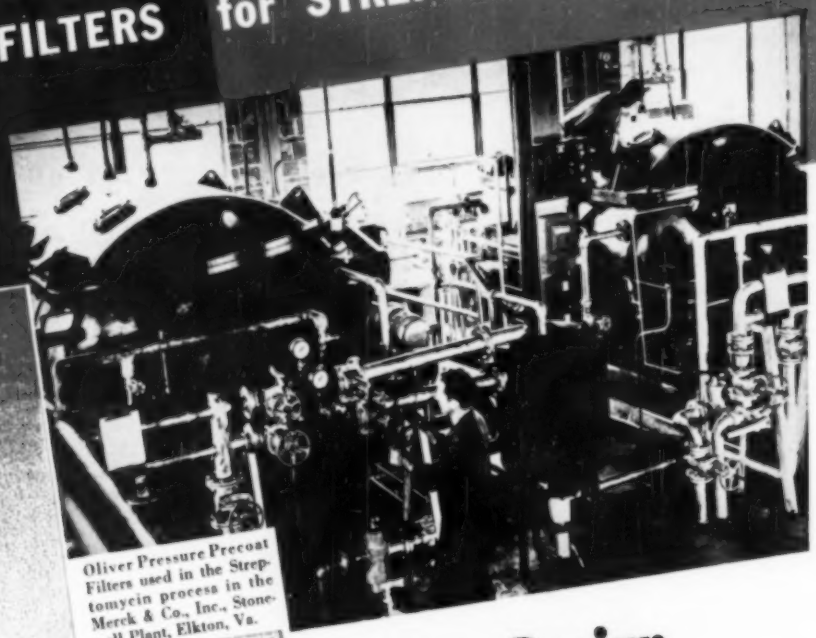
Send, today, for Bulletin 4-R
Let ƒ Fume Scrubbers work for you.

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*Manufacturing Engineers*
*1190 Thompson Street, Philadelphia 22, Pa.*

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# OLIVER PRECOAT FILTERS for STREPTOMYCIN



Oliver Pressure Precoat Filters used in the Streptomycin process in the Merck & Co., Inc., Stonewall Plant, Elkton, Va.

## An Achievement in Filter Design
## helps to bring about
## An Achievement in Chemical Engineering

**OLIVER UNITED**

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33 West 42nd Street

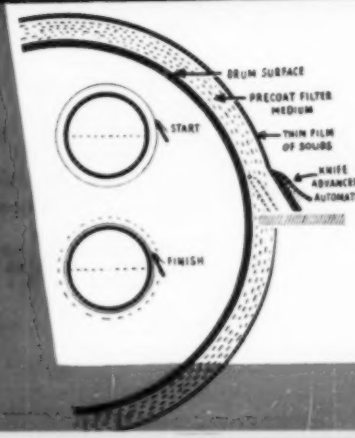
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Principle of Oliver Precoat Filtration: a knife edge, traveling inward slowly, shaves off the film of solids and from 0.001 to 0.0001 inch of precoat, thus providing a fresh surface of precoat for filtration at all times.

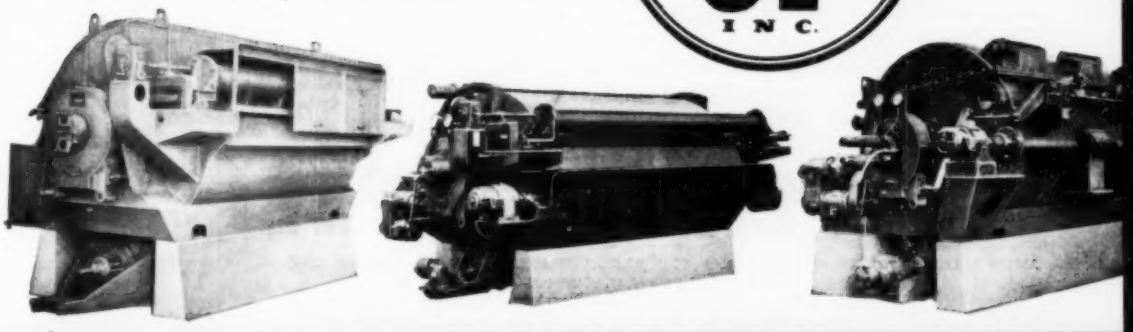
**Merck & Co., Inc.,** at its Stonewall Plant, Elkton, Va., has performed a production miracle. It has turned a laboratory success into a manufacturing achievement . . . a miracle in "tonnage" production of that priceless life-saving medicine — STREPTOMYCIN.

In this production, filtration plays an important part. And in the testing of filtration methods and in the selection of the proper type of filter, Oliver United, too, played a leading role. To this problem, Oliver United Engineers brought the combined values of forty years' filtration experience, wide selectivity of filter types, and two well-equipped testing laboratories.

By a process of elimination, the choice rested on the Oliver Pressure Precoat Filter. This filter, operating under pressure and jacketed to maintain the required temperatures, had just the filtering characteristics required: continuous filtration with a fresh surface of filter aid available at all times for the removal of waste solids from the fermented liquors.

There are four members of the Oliver Precoat Filter family: Pressure, Open Vacuum, Enclosed Vacuum and Hooded Vacuum. The Precoat Filter is ideal for filtering solutions with sticky, slimy, hard-to-filter solids or solutions with very small amounts of solids. If one of the Precoats doesn't fit your problem we have many other units in the continuous vacuum and pressure types. Our engineers will be glad to discuss your problem and make laboratory tests, if necessary.

**FILTERS INC.**



Oliver Continuous Vacuum Precoat Filter Hooded Type

Oliver Continuous Vacuum Precoat Filter

Oliver Continuous Vacuum Precoat Filter Closed or Vapotight Type




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No matter where you are, or where you want steel delivered, there's a Ryerson plant, with diversified Ryerson steel stocks, within quick shipping distance. A network of thirteen big plants, plus twelve district sales offices, makes Ryerson steel service the most comprehensive and convenient in the nation.

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These days, with the record-breaking demand for steel, we may not always have the exact size or quantity you need. But you can be sure we will do our very best to serve you. Usually, from long experience, we are able to suggest an available alternate steel. So, for steel and steel service, call the Ryerson plant or office nearest you.

**Need Stainless? . . . Call Ryerson**

Your nearby Ryerson plant is a quick, convenient source for everything in stainless steel. Bars, plates, sheets, tubing, pipe and other stainless products in many types and finishes are on hand. And stainless from Ryerson stocks means Allegheny stainless, the time-tested product of America's oldest stainless producer. Need stainless? Call Ryerson.



# RYERSON STEEL

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*"Give us the tools . . ."*

# Now is the time to *FIGHT SOCIALISM* in Washington

**Do we want to follow Britain down the economic skids?**

**We Americans face that question today. For we are being advised by Administration economists in Washington to take the course which destroyed Britain industrially. It is the temporarily easy course of cutting down expenditures for tools in order to have more things to consume right away.**

The President's Council of Economic Advisers tells us we are spending too large a part of our national income on new tools and equipment. A larger share, they say, should go for goods and services used directly by consumers.

Before we take that advice, let us look at Britain. When the British once allowed their industrial plants and equipment to run down – they started down a dreary road to industrial stagnation and decay.

British industry once ruled the world. Low production costs enabled it to undersell all competitors. Efficiency gave British workers the highest living standards anywhere.

Now all that Britain has between it and economic disaster is pluck and American aid through the Marshall Plan.

The British people are living poorly – still on rations and in austerity. With practically everyone working, and working longer hours than we do in the United States, they cannot produce enough to pay for the raw materials and food they must import.

*How did Britain get in this fix?*

The story is complicated. British sacrifices in two wars play a tragic part in it. But another fact also stands out:

*Britain began to go downhill even before World War I – when British industries allowed their plants and equipment to grow obsolete.*

Once that process started, it grew steadily worse. By 1929 the share of Britain's national income being plowed back into capital investment had shrunk to less than two-thirds of what it had been twenty years earlier. We were putting twice as big a share of our national income into capital goods at this same time.

**Skimping on capital equipment – on new plants and new tools – put the skids under industrial Britain.**

World War II only speeded up a process already well under way.

continued on next page

British industry today shows the results of its failure to keep up to date. Here are three examples found by Dr. Laci Rostas, Britain's leading authority on measuring workers' productivity:

An American produces *four* times as much pig iron as his British counterpart.

He produces *more than four times* as many tires.

In all industry, on the average, an American produces almost three times as much.

The real reason is the American's better tools. The British are struggling with equipment that is, on the average, forty years old.

Britain once had a big head start in industrial equipment. But she let it slip away. And as it went, Britain's industrial and political leadership slipped with it.

How could British leaders have slept while all this happened?

This, too, is a complicated story. But parts of it stand out clearly:

1. *British business men put in more time perfecting cartels to avoid competition than they did in improving their plants and equipment to meet it.*

2. *British labor leaders concentrated on sharing the work and sharing the wealth—rather than doing the job necessary to have enough wealth to make the sharing worthwhile.*

3. *British governments taxed away the means to buy new equipment. By steadily increasing personal taxes, they undercut the* ability *of individuals to invest in new equipment. Finally, they took away the* incentive *to get new equipment by progressively taxing away any returns on it.*

4. *Farseeing socialists smiled all the while, knowing that as private industry more and more lacked the tools to do a progressive job, they would have their chance to run the country.*

Now, with Britain's fate in their hands, the socialists are trying desperately to stem the nation's economic decline by rebuilding its industrial plants and equipment.

They are making a little headway, but not enough. There are several reasons. One is that Britain must export most of the new equipment she can make. *Another major reason—increasingly important for her future—is that money needed to renovate Britain's run-down industry is taxed away to support welfare programs.* The (London) *Economist* grimly puts it this way:

"The importance of the function of saving has only been discovered now that the means of saving have largely been destroyed."

Our own Federal and State governments, too, have dangerously whittled away incentives. They have more than tripled tax rates on personal and corporation incomes in the last twenty years. Now, the President proposes to do more whittling.

**If the United States is not to go Britain's way, we must preserve our incentives to save and to invest in industry.**

**If the United States is to progress, we must continue to build up our industries.**

The President's Economic Advisers say we can slow down. But the McGraw-Hill survey of "Business' Needs for New Plants and Equipment," reported in the previous editorial in this series, produced facts to the contrary. It showed that industry *now* plans—*if it can get the money*—to spend $55 billion in the next five years for new plants and new tools. Moreover, it showed *industry's needs* for new facilities are large.

By cutting down the incentives to save, by giving soothing advice that we do not need to save so much, Washington is pushing us toward Britain's way—the route via industrial stagnation to socialization.

Before we skid too far, we should pull up short and ask ourselves: Do we want to go Britain's socialistic way?

There still is time to say, "No."

A complete report on our national survey, "Business' Needs for New Plants and Equipment," may be obtained by writing McGraw-Hill Publishing Co., 330 West 42nd St., New York 18, N. Y. This is the fifth editorial of a special series on industry's needs for new plants and equipment.

James H. McGraw, Jr.

*President, McGraw-Hill Publishing Company, Inc.*

CHEMICAL ENGINEERING
with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 MARCH 1949 SIDNEY D. KIRKPATRICK, Editor

# Alpha and Omega

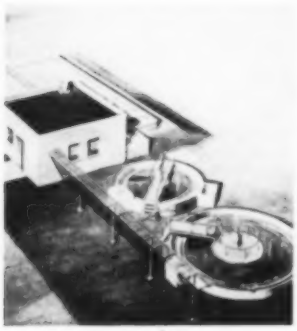
Beginning and end. From procuring the first and most basic of all raw materials—pure water—to the final disposal or utilization of all end products is today's concept of the responsibilities of industry. In this whole cycle of manufacturing operations in the process industries, the chemical engineer holds a strategic and challenging position. Too often in the past he has been concerned too much with the intermediary processes and equipment, too little with such commonplace problems as water supply and waste disposal. Some of the many reasons for this change in attitude will be found in this issue—another in a long series that began in September 1931.

Within the week we saw a modern pharmaceutical plant that had been built a few years ago at the edge of a small residential community. Architecturally it fits very well into its surroundings. But as soon as operations started, there were protests of offending odors. This was eventually cleared up but by a change in process that greatly increased the water requirements of the plant. New wells were drilled while the old ones were pumped so vigorously that the water table of the area was seriously depressed. Again there were complaints from the residents whose wells were being dried up by their thirsty neighbor. Finally that situation was eased by piping in condenser water from a nearby lake which the plant had originally intended to use for dilution of its industrial waste. Therefore, an alternate disposal system had to be installed and meanwhile it became necessary to remove the impounded sewage by employing a fleet of tank trucks and trailers. A less prosperous enterprise would long since have been bankrupt.

In conditions like these we cannot be too quick or certain in placing the blame. Undoubtedly the initial mistake was made in plant location. What followed was merely making the best of a sorry situation. The urgent demand for the product of the industry was such that production had to be pushed at almost any cost. Unfortunately, however, these conditions which we can understand and appreciate are not so readily understood and appreciated by the layman or by those local, state and federal officials who will be cooperating in the enforcement of the new Water Pollution Control Act passed last year by the 80th Congress.

Some of the provisions of the Act and the progress being made in putting it into effect are discussed elsewhere in these pages. The U. S. Public Health Service has set up and is now staffing a nation-wide series of field and river-basin offices "to conduct over-all studies, determine extent and sources of pollution, advise on corrective measures and coordinate state and local programs." The division engineers are anxious to make their work cooperative rather than disciplinary. They would welcome an opportunity to discuss the technical problems involved in their work—and yours.

But all this can still remain in the realm of talk unless we do something about it. The first step is to assume the broader responsibility that comes with the recognition of water supply and waste disposal as the beginning and end of every manufacturing process. Then comes the need for precise planning, efficient design and careful, conscientious operation and maintenance. These are primarily chemical engineering responsibilities.



# WASTE

**Events in the Ohio Valley make industry's prospect former. It tackles the problems of air pollution,**

**SURVEY YOUR PROBLEM**
An Introduction by W. J. Eldridge
E. I. du Pont de Nemours & Co.

■ How does a large process industry go about making a waste survey? In undertaking a stream pollution abatement program, the first step is for the top management of the company to decide upon a policy. Once this policy is determined all plants should be expected to follow it in stream pollution abatement work. Such a policy should include a statement to the effect that the company will abate all pollution which causes nuisance or results in conditions failing to conform to established standards or criteria of water quality. Deciding on such a policy is not enough. It must be publicized within the company so that everyone concerned becomes familiar with it. There must be no doubt about the intention of management to adhere to the policy.

To get effective administration of a company policy on stream pollution control, a man high enough in the organization to make decisions and to have a voice in the expenditure of funds should be put in charge of the stream pollution abatement program. Too often a company, realizing that something must be done to reduce stream pollution, hires someone or assigns a technical staff member to make a survey and recommendations for reducing waste to a satisfactory level. When management gets the report, it is often astonished at the enormity of what has to be done and the amount of money that has to be spent. This happens because nobody in management had been following the progress of the study.

Reporting to the person in management who has been assigned to follow the stream pollution abatement should be a competent specialist on industrial waste disposal. This specialist should have considerable knowledge of the technology and methods employed by the company, as well as previous experience in the solution of industrial waste disposal problems. Training or experience in sanitary engineering, plant production work, research or laboratory work will also be helpful. The industrial waste specialist may require a small staff of engineers to carry out his duties. The size of such staff, of course, will depend upon the size of the company, the number of plants operated and the complexity of the production processes.

To control stream pollution effectively, an industry should set two goals. One is the avoidance of new sources of pollution through the construction and operation of new plants or additional units at existing locations. The other is the accomplishment of necessary improvement in waste practices at existing locations. To reach these goals, pollution control must be considered at every step from research, through design, to plant operation.

When a new product is being developed through research, careful consideration should be given to the wastes which will be produced. Methods for controlling the quantity of waste should be developed at the same time that the new process is being worked out. This may involve either elimination of waste, recovery of waste or some treatment process. Alternate manufacturing processes may produce different amounts of waste. Then the type and amount of waste become deciding factors in selecting the final process.

Designs covering new plants and plant increases must include the necessary facilities for the proper disposal of waste. This applies particularly when considering the location for a new plant, since the degree of treatment will be influenced greatly by local conditions. In fact, this may be a deciding factor in selecting the locatoin of a new plant or in determining the practicability of enlarging an existing plant. Design of the waste collecting system will be influenced by the kind and amount of treatment required. Careful consideration of waste disposal is necessary throughout the design phase. The design engineer, therefore, should work in close cooperation with the company specialist on industrial waste disposal.

To guard against new sources of waste and to accomplish satisfactory improvements at established plants, one of the most important factors in the pollution abatement program is the industrial waste organization at the individual plant. Therefore, the organization and execution of a pollution abatement program for a single plant will be detailed. Older plants often lack adequate facilities to dispose of waste in a manner which meets modern standards. It is, therefore, necessary to obtain data on the quantity of waste, the individual sources which contribute waste and the probable amount of reduction which will be required. Such information can only be obtained by making a very careful survey of each plant and car-

# DISPOSAL

**clear: Control or be controlled. This *Chemical Engineering* Report attempts to help achieve the pickle liquor, atomic wastes and, on this page, the technique of your own waste survey.**

rying out a program designed to reduce the amount of waste discharged.

First emphasis in such a program will be on general housekeeping and improvements in efficiency followed by process changes or installation of equipment either to eliminate waste or to recover materials. Next step will be the installation of equipment for treating the waste to bring about any further reductions which are necessary. Degree of treatment should be based on standards established by the state stream pollution control agency or, in the absence of standards, on preventing nuisance or damage.

To achieve the objectives just discussed, a general method of attack which has been used successfully is presented.

A competent person should be selected to supervise the work. His qualifications should be similar to those of the person assigned to serve as specialist on industrial waste disposal for the company, but his knowledge of company processes need only include the ones in use at the plant where the work is to be done. Whether this person has other duties depends on the size of the plant.

If the plant is large or the waste disposal problem complex, more assistance may be required. Such assistance may be furnished either by selecting or employing persons to work under the man in charge of the program or by making available to him the assistance of the engineering and technical groups.

Funds should be provided so that the person in charge of the program not only can carry on his routine duties but also undertake experimental work in small units to evaluate promising methods for recovery or treatment of waste.

People engaged in this work should have access to company records which show quantities of raw materials used, cost of these materials, amount of product manufactured, production costs, sales prices, unit cost of utilities and other information needed to evaluate the problem.

The supervisor of the program should call on the company waste specialist for guidance in planning, organizing and executing the work. As the study progresses, the company specialist should be kept informed on all phases of the work. Thus he will be in a better position to serve when his assistance is needed. It is also important that he have complete information on the individual company plants so that he can keep top management informed on the status of pollution abatement work.

Once started on a plant survey, one of the first things to be done is an analysis of the material records to determine the total quantity of each material consumed per pound of production. When continued on a month-by-month basis, such analysis provides an excellent measure of progress being made in reducing waste. This information when plotted graphically illustrates to plant management the progress being made in stream pollution abatement.

A study of the plant material records is incomplete unless material balances are made for each major material received at the plant. Such a balance is designed to account for all materials received in a given period. It calls for data to show how much material was shipped out with the finished product, how much reached the sewer at each stage in the process, the amount hauled to the dump and the amount lost to the atmosphere. These material balances clearly indicate the points at which material is lost and show the amounts involved. Therefore, they show the parts of the process which should get early attention and the places where waste may be eliminated or where it may have to be collected.

A system of records should be set up to make readily available complete information on the status of the program. Records should include information developed from plant material records, information on rate of production, the quantity of each material which is discharged to the receiving stream, the volume and analysis of the waste stream, and the flow and analysis of the receiving waters. There are other items which probably belong with those enumerated. Items to be included depend upon the particular plant and the local conditions.

Facilities should be provided for doing experimental work and running analyses of plant wastes. Much equipment for this will be found in plant control laboratories. Specialized equipment will be required for making certain tests. Analytical determinations to be made on plant waste will be governed by materials known to be present in the waste and by the standards which must be met.

Sampling facilities should be pro-

vided. Samples should be collected from the main plant sewer, from individual sewers and from the stream into which wastes are discharged. Sampling equipment required will vary with conditions encountered. Sometimes spot samples will suffice; at other times composite samples should be collected. Total samples will suffice; at other times composite samples should be collected. Total samples taken will also depend upon the number of outlets discharging into the receiving stream and upon the probable variations in concentration resulting from batch ditching of waste.

Waste analyses must be accompanied by measurement of volume. It is necessary to get data not only on the concentration but also on average, maximum and minimum flow of waste in the main sewers and from individual operations. Complete data should also be obtained on any intermittent operations or operations which produce waste which is not discharged on a continuous basis.

### Stream Surveys

To determine the effect of the waste upon the receiving waters, surveys should be made of the receiving stream. Information collected, of course, depends upon the type and quantity of waste being discharged. It will generally include stream flow, dissolved oxygen, biochemical oxygen demand, pH, alkalinity or acidity, temperature, insoluble solids, total dissolved solids, compounds producing taste and odor, and sometimes toxicity tests or analyses to determine the concentration of particular chemicals which might produce a toxic effect if present in sufficient quantity. Samples should be taken from a location above the discharge point for the plant wastes and for some distance downstream. In taking samples downstream, an effort should be made to determine the zone of maximum oxygen depletion and, if possible, the zone where stream recovery is practically complete. This is often complicated by other effluents from cities and industries discharging into the same part of the stream.

The supervisor of the stream pollutoin abatement program should publicize results achieved. After all, reductions in waste are of interest to those responsible for plant operation and are often the result of work done by technical, operating or engineering people. Efforts should be made to keep stream pollution abatement in the minds of operating and technical men at all times. There are many ways of doing this.

Frequent letters and reports should be submitted, pointing out conditions that need correcting and outlining ideas and suggestions for reducing waste. Also, periodic progress reports on the abatement program should be made. These letters and reports keep before the operating organization the need for waste reduction. They record progress and show that the company has been diligent in its efforts to control pollution.

Meetings should be held with management, technical, engineering and operating people to discuss industrial waste problems. These meetings can be called to present recent developments, to carry on an educational campaign and to secure ideas and suggestions for further reducing the quantity of waste.

Showing of motion pictures like "Clean Water" and using posters also benefit the campaign to publicize pollution abatement. Such publicity makes all plant personnel conscious of the need to reduce waste. It brings to them the realization that it is of vital interest to all of them that wastes be minimized.

Periodically a work program should be prepared. Items included in this program will, of course, depend upon the urgent needs at the time. At the start of a pollution abatement program, however, work should be directed toward making reductions in the amount of objectionable wastes which will require the least change in the process or that can be accomplished for the smallest investment.

### Special Treatments

Along with work on waste recovery methods, a study should be undertaken to determine applicable methods of treatment for certain wastes. At first these studies should be concerned with those wastes which obviously cannot be recovered or which would require expenditures for recovery equipment greater than the cost of treatment. Often, however, a sum spent for recovery equipment will earn some return, whereas the same investment in waste treatment equipment to accomplish the same reduction will show no return. Moreover, money invested in equipment for the treatment of waste represents capital on which an income must be earned. The cost of operating such equipment, therefore, becomes a part of the cost of producing goods and is, accordingly, reflected in the selling price.

In practically every case, it will be necessary for industry to provide equipment for the treatment of sanitary sewage, as well as equipment for removing settleable solids and floating matter from industrial waste. Where this is indicated, it should get early attention in the stream pollution abatement program.

At this time consideration should be given to the possibility of collecting the sanitary sewage and a part or all of the industrial waste for discharge into a municipal system. Where this can be done without causing damage to the sewerage system and without upsetting the municipal treatment plant, it may prove to be the most economical course. Before a final decision can be reached on this point, very accurate information on the quality and quantity of industrial waste will be required. Where satisfactory arrangements can be made with a municipality, pre-treatment will often be necessary to prevent damage to the municipal system. Cost of doing this will have to be compared with the cost of improving waste quality sufficiently to discharge it directly into the receiving stream.

### Consultant Service

In the course of a program such as the one herein discussed, problems new to company personnel will arise. Help will be needed on these problems since they will call for knowledge and experience outside of the normal field of work of the company people. Then the services of a capable private consultant should be employed. Such an arrangement can be readily employed to advantage. There should be no hesitation in calling on consultants when their special abilities are needed.

The supervisor of the stream pollution abatement program should get to know the representatives of the stream pollution control agency. Their advice and assistance will often be helpful. These men wish to work with industry on a cooperative basis. This can best be done by free exchange of information, omitting only trade secrets. Moreover, when the pollution control agency is kept informed, it is aware of progress being made, knows of difficulties encountered and can tell the interested public the things that industry is doing to abate polution.

As far as possible, there should be a free exchange of technical information on waste treatment methods between industrial companies. This is considered very important. Meetings foster such an exchange. Those responsible for carrying out pollution abatement programs should maintain memberships in technical societies and trade associations. These people should participate as far as possible in discussions on stream pollution abatement.



Milk waste treatment, Carnation Milk Co.

WASTE DISPOSAL . . .

# The Ohio Valley Program Marks a Trend And Points a Moral

**If industry lets government takes the initiative—industry can expect government control.**

**THE OHIO RIVER VALLEY COMPACT**
**A** Critical Riview by the Editorial Staff

■ INDUSTRIAL sewage and its control has for many decades been the subject of much discussion, arguments, planning, experimentation and politics. It will continue to be the subject of more of the same, with this important change: henceforth the stress will be more on action, less on arguments. For in July, eight states in the Ohio basin signed the Ohio River Valley Water Sanitation Compact to set in motion a 15-year, $400,000,000 municipal and industrial sewage control program. On the same day, President Truman signed the Barkley-Taft Water Pollution Act that authorizes the U. S. Public Health Service to issue cleanup orders, provides for federal court action against offenders. Here, then, are anti-pollution laws with a full set of upper and lower teeth. As industrialists and engineers, it's your duty and responsibility—and salvation—to see to it that they have to be used as seldom and as gently as possible.

The Ohio River Valley Compact is of direct concern to every industrial plant in that area. Its significance, however, is definitely national; it sets the pattern for a trend that will be accelerated. The Barkley-Taft Act, of course, doesn't leave a corner of the nation uncovered.

For many years the chemical and process industries have given serious study to water pollution and its prevention; a vast amount of experimental work and full-scale corrective measures have been undertaken. Industry is not necessarily the major and non-cooperative offender, as is so often stated or implied. This was clearly brought out in the Ohio studies. Yet remember this easy sequence: when a situation becomes bad (real or partly imaginary, it makes little difference), the public is prone to get impatient, special groups to put on the pressure, politicians to make promises. For the firm or industry that cannot justify its actions or is not prepared to defend itself with vigor, the stage is already set for it to become the guinea pig *and* the goat for both politicians and the public. That's a hot spot in any industry's language.

### What Moves, What Order

To avoid any possibility of finding yourself in such a spot, here are our recommendations: (1) study in detail the Barkley-Taft Act, your local and state regulations and the reports on the Ohio River Basin*; (2) if you have facilities for treating wastes and pollutants, check again to make certain that any effluents are within all legal limitations; (3) if you have any untreated liquid effluents, assign at once competent technical and engineering personnel to study these and to develop the best ways of treating them; (4) plan to install any treating facilities that seem necessary as soon as possible, but consult first with your local and state pollution control organizations; (5) encourage and cooperate with any industry-wide or regional studies or programs; (6) follow closely all local, state or national proposals for control and regulation of wastes—if instead you follow the tendency to let them slide by largely unnoticed, most likely you'll be shocked and hurt by the resulting law; (7) prepare and have ready for short-notice use factual ammunition on your present situation, what you have already done and what you intend to do; (8) plan, cooperate and act at all times in good faith with pollution control and regulation officials. In general, it's a wiser policy to approach than to be approached. But don't necessarily acquiesce to every unreasonable whim.

In many ways, the studies on the Ohio River Valley are the most com-

* House Document No. 266, 78th Congress, 1st Session; reports in two parts (three volumes) on Ohio River Pollution Control, published in 1944, U. S. Government Printing Office, Washington, D. C.

plete and comprehensive ever made on pollution control for a large area highly developed in commerce, agriculture and industry. More than 71,000 water samples from 2,000 stream stations were examined; some 3,700 municipalities and 1,800 industrial plants were covered. Cost of the five-year study was approximately $600,000. It was made by the U. S. Public Health Service for and with the assistance of the Army Corps of Engineers under the general direction of the Ohio River Committee. The states in the Basin were authorized by Congress back in 1936 to enter into the agreement.

### Set-Up—And Significance

The Compact will have a governing body of three commissioners from each of the eight states that have signed and three from the federal government. Chairman will be Hudson Biery of the Cincinnati Street Railway Co.

Tying in closely with the Ohio Compact, the Barkley-Taft Act provides for a 10-man Water Pollution Advisory Board in the Public Health Service. Chairman will be the Surgeon General or his representative. It will include representatives from the Army, Agriculture, Interior, Federal Works Agency, and six non-government members to be appointed by the President. One will represent industry; the remainder will be experts from the fields of sewage and industrial waste disposal, municipal government, state government and wild-life conservation. The Board will review policies and programs of the Public Health Service and make recommendations to the Surgeon General. The Act (1) authorizes the U. S. Public Health Service to issue cleanup orders; (2) provides for federal court action against offenders; (3) authorizes $22.5 million a year for the next five years to provide loans to build sewage disposal works; (4) allots $1,000,000 a year to the Federal Security Agency for research grants; (5) provides $1,000,000 a year for surveys by municipalities preliminary to construction of projects for which loans have been approved.

Moral of the Barkley-Taft Act: if municipalities and industry cannot clean house locally, the federal government can now step in.

### Back to the Ohio

The Ohio River drains some 203,900 square miles or almost 7 percent of the United States. It has over 14 percent of the nation's population and includes portions of Alabama, Georgia, Illinois, Indiana, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia.

Portions of the Basin are highly industrialized; agriculture, mining and manufacturing are extensive. Principal natural and manufactured products include coal, limestone, natural gasoline, petroleum, natural gas, salt, nonferrous metals, iron and steel plant products, rubber goods, cement, chemicals, beverage products.

Polluting strength of the area's wastes, despite all corrective measures, were summarized:

| | Population Equivalent (BOD Basis)* |
|---|---|
| Sewered domestic wastes | 6,396,400 |
| Industrial wastes | 9,071,700 |
| Total organic wastes | 15,468,100 |
| Acid wastes (tons per year of $CaCO_3$) | 1,864,800 |

Much of the industrial wastes served by municipal treatment—and over 30 percent of those not served—are from food processing and allied industries. Next come the chemical industries, with 21 percent of the industrial waste population equivalent not served by municipal treatment. Paper and strawboard plants contribute over 15 percent.

Acid wastes, largely within the bituminous coal fields, are 98 percent from coal mines. Minor amounts represent spent pickle liquor discharged by metallurgical industries. Acid pollution is so heavy that the waters of some areas have a monthly average pH of 4.0 or less. Such values give a corrosive water that is unsuitable or undesirable for use in cooling, boilers, certain processing operations, and for most public, industrial and recreational use. Annual damage from acid wastes in the area upstream from where the Ohio crosses the western boundary of Pennsylvania is estimated at $2,000,000. More than half of this is to navigation.

Significantly, the report points out that considerable progress has been made in providing corrections in some of the areas. It recommends that its corrective program be completed in 15 years, yet states that if the rate of progress which prevailed during the period 1935-1940 were resumed after the war, the program would be completed within 20 years. It stressed the need for a comprehensive program of research to develop new and more economical methods of waste treatment and recovery.

### Difficulties and Why

The technical, financial, legal and administrative difficulties in any major pollution abatement program are proverbial to most persons except, unfortunately, some politicians, pressure groups and the public—the very groups that are most prone to push through ineffective, "quickie" corrections. Many technical difficulties arise, as the Ohio reports emphasize, because there are still no known satisfactory methods of treating some industrial wastes. Others require very complex treatment; with others, the methods must be so extensive as to make adequate control extremely tedious and frequently only partially effective.

Financial difficulties, mainly those of distributing equitably the cost of abatement works, are perhaps even more snarling. With few exceptions, benefits cannot be evaluated with sufficient accuracy to allow a satisfactory economic analysis of specific projects. Furthermore, the sources of pollution (which might reasonably be expected to bear the cost of regulating their own waste disposal) usually receive little or no benefits from their own improvements. In other cases, the communities and people who live and thrive on industrial enterprises insist that the full burden be borne by industry—occasionally to the point of crippling or killing the goose that lays the golden egg. Where should—or can—the line be drawn between public and private responsibility?

The Ohio committee lays down this important decision: major pollution abatement costs should be divided equitably between the polluter, who has a definite responsibility, and the beneficiaries of the improvements. The present status, it adds, should be made the starting point and future financial burdens should be borne by originators and recipients in proportion to their responsibilities and requirements. But what is an "equitable distribution" and who is to define it? Some industries or plants will doubtless much prefer to assume full responsibility in order to keep full control of their own operations.

An idea of the financial magnitude of the Ohio Valley program can be gained from the following figures. Capital costs of the recommended pollution control program for the Basin are estimated at close to $180,000,000 or $9.50 per capita based on total population. This includes provisions for interceptor sewers but excludes community systems. It allows 15

* BOD (biochemical oxygen demand) is a measure of the amount of dissolved $O_2$ which may be absorbed from a stream water in 5 days at 20 deg. C. to support the biochemical oxidation of the organic pollutants carried in the stream.

percent for engineering and contingencies. Annual charges were estimated at $18,400,000 or about $1 per capita. Estimated capital cost of the program for independent industrial treatment, pre-treatment and connections was placed at $13,580,000. Estimated annual cost of operation and maintenance for the industrial treatment phase was $2,474,000 while amortization and interest was $1,793,000 (amortization of 10 years or less, interest at 5 percent). Annual charges of the program for independent industrial treatment, if borne by the general public, would be about 23c. per capita; charges for individual basins would vary from 0-51c. per capita per year.

### Corrections and How

Various methods are used to reduce the amount and effect of harmful suspended or dissolved substances before they reach streams: screening, sedimentation, flocculation with or without chemicals, bacterial action, neutralization, industrial recovery, evaporation, filtration, disinfection. These may be used singly or in combination.

A primary treatment plant for domestic sewage usually consists of screening and sedimentation to remove about 50 percent of suspended solids, 35 percent of BOD and 25-50 percent of disease-causing bacteria. Chlorination may be included to remove 90-95 percent of the pathogenic bacteria.

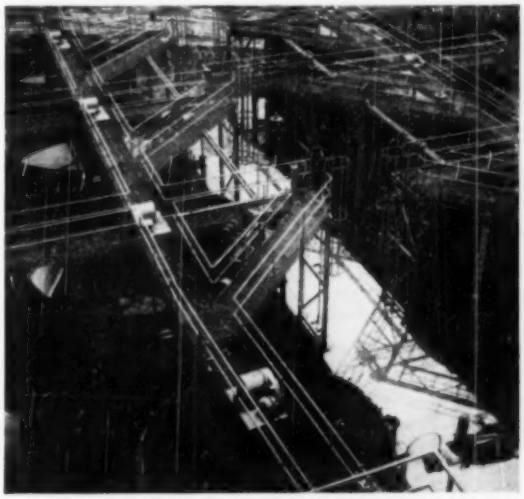
Additional facilities may be added to a primary plant; these are collectively known as a secondary treatment plant. Practically all harmful substances and bacteria will be removed by a secondary activated sludge (bacterial action) plant using final sedimentation, filtration and disenfection.

Although no single measure of pollution can be used for all types of industrial wastes, that of BOD is probably most satisfactory. Sewered population equivalents of industrial wastes were based on 0.167 lb. of 5-day, 20 deg. C. BOD per capita per day. In a few cases, sewered population equivalents were based on 0.2 lb. suspended solids per capita per day. This measure is of interest to industrial plants which discharge to municipal treatment plants, particularly those of the plain sedimentation type where sludge quantities are important.

Chemical precipitation is popular in industrial treatment plants since (1) its operation is little affected by great variations in load and toxic materials; (2) capital costs are less than for biological processes. Where removal of settleable solids is sufficient, the problem is not difficult. But satis-

## A Multitude of Sins

**These pictorial footnotes show the diversity of the problems and the weapons engaged in the "Battle of the Ohio Valley."**



**METAL-WORKING WASTES. Battery of cyanide and acid treatment tanks, Talon, Inc., Meadville, Pa. Plant is also on cover.**



**TANNERY WASTES. Sedimentation unit, with mechanical flocculators and horizontal sludge collectors, removes 60-70 percent of suspended solids.**



**STEEL MILL WASTES. Clarifier for blast furnace gas scrubber water, Interlake Iron Corp., Erie, Pa.**

factory methods for rather complete removal of BOD can be used for only a few of the more common types of wastes, such as those from breweries, meat and milk plants and some types of canneries and distilleries. Again the Ohio reports point out the pressing need for more efficient and economical ways for complete treatment of other types of industrial wastes.

Reduction of industrial waste pollution is generally done by one or more of three ways:

1. *Plant Changes*—This may mean reuse of all or part of the waste, development of byproducts, changes in processes, or simply greater care in plant operation. This method is usually the most economical and is quite generally applied. Sometime it is possible to completely remove pollution and to recover valuable byproducts. Usually, however, some pollution remains and some expense is involved.

2. *Treatment With Municipal Sewage*—Many industrial wastes can be treated effectively in this way. It is often necessary to pretreat the waste at its source or to segregate certain portions within the plant and exclude these from municipal sewers to prevent damage to the sewer structure or treatment process. It is usually necessary to make special provisions in the design of a municipal plant if an appreciable amount of industrial waste is to be treated. Later changes in the industrial waste load sometimes cause trouble. In general, this method has certain advantages: (1) it is the simplest for industry; (2) it is the most satisfactory in administration of abatement programs; (3) it reduces the number of possible sources of pollution; (4) it concentrates responsibility for effective treatment.

3. *Treatment in Special Plants*—This method is used when the first is insufficient and the second is impractical. Most plants that have specially developed processes use sedimentation to remove settleable solids. Segregation of cooling and other inoffensive waters for separate disposal is almost universal practice. Separate collection of highly offensive or concentrated materials for special attention, utilization or recovery will often reduce pollution and costs over other methods.

Industrial wastes may be objectionable for many reasons, such as: (1) high organic or BOD content; (2) suspended solids; (3) chemicals toxic to aquatic life; (4) excess acid, hardness or salinity; (5) taste- and odor-producing substances; (6) undesirable coloring matter.

■ In preface to the industry case-history studies which have been abstracted from the Ohio reports, we wish to emphasize several points: (1) The specific examples are not intended to direct the finger of accusation at any particular industry but only to illustrate the type of studies made and the kind of data obtained; (2) the data have been generalized and most often cannot be applied with complete accuracy to any particular plant or operation; (3) most of the figures were obtained over a period of years and changed conditions may have altered some of them; (4) most important, study the original reports for definitions, details, sources of information and modifying conditions —these cannot be included in this abstract.

## OIL REFINERY WASTES

Oil refinery wastes may contain: (1) free and emulsified oil; may form a film on the water, coat objects, retard atmospheric re-aeration, occasionally cause a fire hazard, generally interfere with normal water uses; (2) substances that may cause tastes and odors; (3) substances that tend to deplete the dissolved oxygen content of water; (4) suspended matter that may form sludges.

Waste flows from oil refineries are large, averaging 700 gal. per bbl. of oil processed at 41 refineries in the Ohio basin. If the water is not re-used, cooling water accounts for 80-90 percent of the waste flow. BOD of combined wastes is low—10-30 ppm.—and suspended solids are usually within the range of 25-75 ppm.

There are a number of sources of wastes. Crude handling and storage operations may allow escape of free and emulsified oils and of water containing organic and inorganic substances in suspension and solution. Distilling and cracking produce or release organic sulphur and nitrogen compounds and other substances. Treatment of distillates gives liquors and sludges with escaped oil fractions, phenols and naphthenic acids. Miscellaneous waters containing oil and solutes may be discharged from gas purification and recovery processes and from those to recover chemical reagents and byproducts.

Sedimentation and flotation basins are standard refinery items for separating the oil, water and settleable solids. A separator has been designed which is reported to produce an effluent containing only 15 ppm. of oil when operating under favorable conditions. It includes two-stage settling; mechanical sludge removal in the first stage; and inlet compartment having Raschig rings or some agglomerate to cause film rupture and distribution; elimination of interior baffles; improved baffles at the outlet of each settling compartment. Where local conditions demand more complete oil removal, either straw, excelsior, coke or clay filters appear to be most practicable. Chemical treatment has been tried experimentally with good results; but costs are high because of the large volumes requiring treatment.

Removal of emulsified oil requires segregation and separate treatment of the portion of the waste containing the emulsion. Processes are available for breaking practically any refinery emulsion, but the proper process for use in any particular case must be determined experimentally.

Detailed information on control of pollutional constituents other than oil has been developed by the API committee on disposal of refinery wastes. Complexity of the industry, rapid technological changes, and the need for independent treatment of each waste at or near its source makes the job of abating pollution by refinery wastes particularly difficult. In general, only petroleum engineers and technologists are able to cope with the problems.

## TANNERY WASTES

A vegetable tannery produces wastes principally from the processes of cleaning, unhairing and fleshing the hides, tanning, and from bleaching the tanned leather. They contain hide and substances, fats and various chemicals: lime, sulphides, tannins, soda ash and sulphuric acid. Combined wastes are usually highly alkaline, but those from the tanyard and part of the bleach wastes are acid. Large amounts of undissolved lime make

them high in suspended solids. Spent tan liquor and soda bleach wastes are strongly colored. This color is difficult to remove.

On the basis of 100 lb. of green salted hides, a vegetable tannery will produce about 68 lb. of finished leather and 800 gal. of combined wastes having total solids of 7,200 ppm. and a sewered population equivalent (BOD) of about 4.8. The pH is about 11. These figures, however, vary widely among plants—up to 600 percent in some cases.

Tannery wastes have a de-oxygenating effect on stream water. Large amounts of suspended solids may cause sludge banks which give off obnoxious odors. The liquor reacts with iron to form an ink-like substance which may be noticeable for many miles.

Untreated wastes have caused difficulty in municipal sewers by depositing suspended solids and by forming $CaCO_3$ scale. The alkalinity may sometimes damage biological processes in sewage treatment plants. Chrome salts may be toxic to the organisms necessary for sludge digestion. There is relatively little danger of anthrax being present; it is standard practice to disinfect all suspected hides before processing.

### One Common Treatment

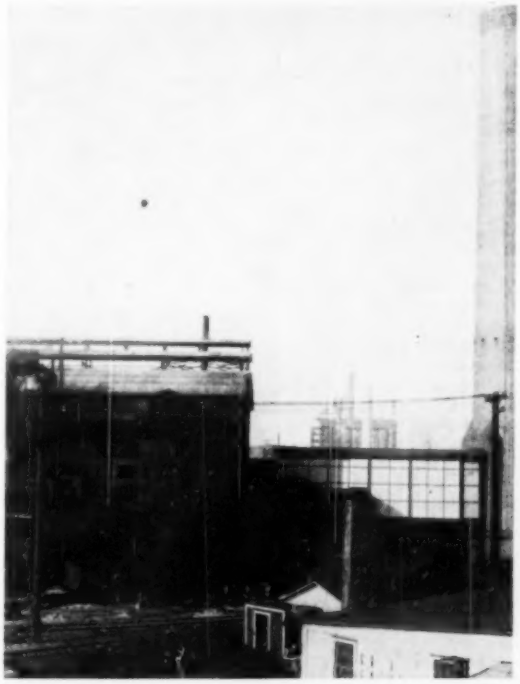
The only treatment method in common use is that of mixing the acid and alkaline wastes, followed by sedimentation. Secondary treatment devices have been tried experimentally; high cost has prevented their wide use. Chemical precipitation has been studied and found effective—but expensive. The sludge disposal problem is difficult; from 7-10 percent of the waste volume is sludge. Vacuum filters and centrifuges have not proved satisfactory.

Lime sludge from the liming vats may be allowed to settle, shoveled out and used for fertilizer or for liming fleshings. If slurried and discharged, it adds greatly to the suspended solid load and to causticity.

Spent tan liquors may be condensed for reuse or evaporated and sold as a boiler compound. Spent tanbark is commonly burned; it can be used in the manufacture of white lead in certain locations. Improvements in the tanning process promise to reduce the volume of spent tan liquor discharged; considerable progress has been made in recent years. Use of dimethylamine to supplement sodium sulphide will reduce BOD of the wastes, eliminate a considerable part of the sulphides. Sedimentation of either the combined wastes or of stronger wastes is the



**REFINERY WASTE WATER.** Waste water separator, Standard of Indiana, Whiting, handles 110 million gal. per day, occupies some 95,000 sq.ft.



**REFINERY SLUDGE.** Installation for disposal of soot and $SO_2$, Standard of Indiana, Whiting. Decomposition of acid sludge, to produce $SO_2$ for contact plant, also yields byproduct coke. Its combustion for process heat produces large amount of soot. Special furnace in building at left burns soot and heats gases to 1,000 deg. F. At this temperature any $SO_3$ in effluent gas from acid concentrators is converted to easily dispersible $SO_2$. Gases from furnace and from contact absorbers are dispersed from stack at right.

only method of tannery waste treatment in common use.

Mixing of wastes and sedimentation will remove experimentally 70-80 percent of suspended solids and 40 percent of BOD. Exclusion of tan liquors increases the percentage of BOD removed. Detention time is 24 hr. or more. Segregation of spent liquors and soda bleaches is common where color reduction is desired; these are lagooned and discharged to streams during periods of high flow.

Added efficiency from chemical treatment is generally too small to justify use of chemicals. But one plant does use flue gas to reduce caustic alkalinity of wastes in order to prevent $CaCO_3$ from depositing in sewers. Secondary treatment by biological processes is used to some extent.

Lagoons for storing spent tan liquors and soda bleaches should have a capacity of about 325 gal. per lb. of hide per day. Sludge beds should have about 1 sq. ft. of area per pound per day.

## DISTILLERY WASTES

Liquid wastes in a distillery are usually from: (1) milling; (2) yeast room operations; (3) equipment washes; (4) tailings or lutter water; (5) still slops; (6) spills.

During the process of yeasting, some small grains may be sent to the sewer in small amounts. As many tubs are required, washing and sterilizing of equipment produces a large waste that carries yeast, grain and mash. Waste flow may be 5-8 gal. per bu. of total grain mashed.

Equipment washes include all processing and sterilization, beginning with mashing and ending with fermentation. After each run, equipment is given a final scrubbing with steam and water to clean out solids remaining after the wash-down. This wash contains portions of mashed grain and fermented beer. It was estimated that a plant with a capacity up to 1,000 bu. would have about 500 gal. daily of equipment wash; plants with daily capacities of 1,000-3,500 bu. would produce about 1,000 gal.

Tailings or lutter water, which includes the aldehyde and fusel oil retained in the doubler, is discharged to the sewer or re-run through the main still to end up in the slop discharge. It is low in oxygen and BOD. Estimated quantity of this waste is 0.75-1.0 gal. per bu. of grain mashed.

De-alcoholized slop from the still is high in solids of which about 50 percent is in solution. This effluent averages about 42-51 gal. per bu. mashed. When it is passed over a double-O punched hole screen, enough thin slop passes through to make up the necessary quantity for setting back to the fermenters. The balance or whole slop of 28-34 gal. is discharged, sold to farmers, fed to cattle, treated for recovery of solids, or used for irrigation. If recovered, the slop is run over more screens and further treated to reduce moisture to about 90 percent. It is then pressed and passed through a revolving steam dryer that reduces moisture to 5-7 percent. The recovered grains, valued as a stock food, average 8-10 lb. per bu. of total grain mashed. Thin stillage from the screens, drag box, and press are disposed of by various ways. This effluent represents about 26-28 gal. per bu. of grain mashed.

Whole slop discharged from the still in the manufacture of grain alcohol has a solids content of about 6.5 percent if back-slopping is practiced. If spent grains are screened and dried, the thin slop has about 4 percent total solids. Grain distillery slop is highly acid, having a pH of about 3.8, and causes corrosion damage to equipment, especially screens. Chlorine demand is about 541 ppm. and BOD approximately 34,000. Evaporator condensate has a BOD of 1,230. Average population equivalent (BOD basis) of combined wastes for a grain distillery is about 60,000 persons per 1,000 bu. mashed daily. The chief effect of distillery waste pollution on streams is that of de-oxygenation.

Raw materials and products in a typical grain distillery are:

| | Per Bushel Mashed |
|---|---|
| Corn and/or rye | 0.9 bu. |
| Malt | 5.6 lb. |
| Proof-gallons | 5 gal. |
| Back slop (thin) | 14-17 gal. |
| Water (process) | 20-24 gal. |
| Water (cooling) | 30-600 gal. |
| Water (make-up for cooling towers) | 20 gal. |
| Total spent slop | 42-51 gal. |
| Total slop for disposal | 28-34 gal. |
| Total thin slop for disposal | 25-27 gal. |

Slop from molasses distilleries has very little suspended matter and about 20 percent total solids. Tailings from the doubler or rectifying still is very low in solids. Population equivalent of molasses slop is about the same as for the combined wastes from a grain distillery.

### Treatment

The process of recovering spent grains from slop by screening and drying is used in practically all distilleries. Disposal of slop by feeding to cattle near the distillery is not satisfactory due to odors, effluent from pens discharging into streams, and inferior class of meat produced. Farmer stock feeding with slop is fairly successful. Costs to small distilleries are low, harmful effects on streams are reduced or eliminated due to the larged area of distribution, and with a balanced diet the production and quality of milk can be satisfactory.

Broad irrigation and lagooning is used only to a limited extent. The chief disadvantage is from fly breeding and odor. Pumping is required and frequent cultivation of irrigated land is necessary. Approximately one acre can be irrigated for every 10,000 gal. of slop per day.

Evaporation of slop is a sanitary method of disposal and is widely used. Costs are reasonable for larger distilleries, excessive for the smaller ones; here disposal to farmers is more usual. Triple effect evaporators commonly used have an advantage over single effects since 2.5 times the amount of liquid can be reduced by the same amount of heat. Evaporation requires a primary reduction of solids by screens, drag box and press; actual evaporation is applied to the thin slop. Products are a thin sirup and a watery condensate. The thin sirup is mixed with previously dried grains or with press cake before entering the dryer. Evaporator condensate, with a BOD of about 1,230 ppm., is discharged to the sewer. Since it is sterile, it can be used to advantage in making process dilutions.

Treatment of distillery waste by anaerobic fermentation has been studied on a pilot plant scale; it is not in commercial use. Digested effluent was treated on a trickling filter after dilution in a ratio of 1:15 with filter effluent. This overcame objectionable odors. A stable effluent was obtained in which dissolved and nitrate $O_2$ exceeded the BOD.

One distillery uses a Dorr thickener to treat still slop in conjunction with a quadruple-effect evaporator and centrifugals. Thin slop from the thickener goes to the evaporators, settled solids to the centrifuge, with the thin waste returning eventually to the thickener. Cake from the centrifuge and sirup from the evaporators are mixed and dried. Effluent from the evaporators, colorless with a slight grainy taste, had a BOD of 6.5 ppm.

Another method, evidently not in commercial use, heats slop to 240 deg. F. and filters it through a cloth. The filtrate may be treated by a trickling filter or by chlorination and the lactate precipitated by $CaCO_3$.

## BYPRODUCT COKE WASTES

Water carrying waste products from a byproduct coke plant comes from the ammonia still, final cooler, benzene operations and caustic scrubber. Other wastes include cooling water, quench water, water to atmosphere, spent sulphuric acid and pure still residue.

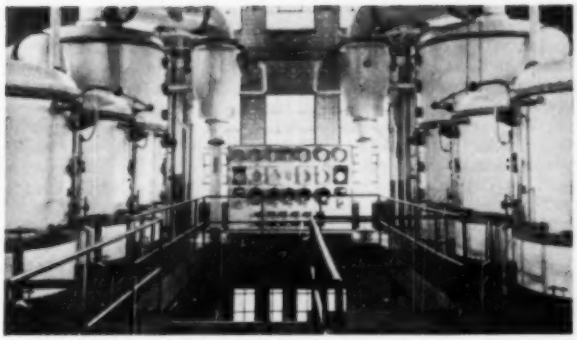
Volume of ammonia still wastes in the plants studied varied from 10 to 36 gal. per ton of coal carbonized. The lowest figure, less than normal, came from a plant that did not recover ammonium salts. The ratio of ammonia-still waste to ammonia liquor in the plants ranged from 1.1 to 1.5. In general, 22 gal. of ammonia-still waste can be expected from each ton of coal carbonized daily. Average analysis of these wastes from three plants was: 5-day, 20-deg. BOD of 3,974 ppm.; total suspended solids of 356 ppm.; organic and $NH_3$ nitrogen of 281 ppm.; phenol of 2,057 ppm.; cyanide of 110 ppm.

Quantity of water used in the final cooler will vary with temperature of the water and volume of gases cooled. Many plants recirculate the water, eliminating this source of pollution. Volume of cooler water per ton of coal carbonized ranged from 150 to 542 gal. Average was about 315 gal. At one plant, final cooler water averaged 218 ppm. BOD, 14 ppm. organic and $NH_3$ nitrogen, and 105 ppm. phenol.

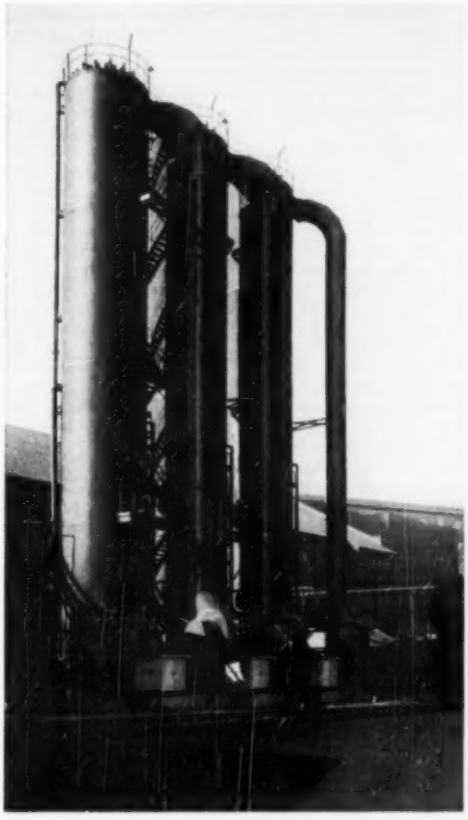
Direct steam distillation in the stripping, and pure stills of wash oil, and light oil gives a condensate which carries oily substances generally referred to as benzene. Volume of this waste depends on quantity of benzene in the gas which, in turn, is determined largely by the nature of the coal and the carbonization rate. Amount from five plants ranged widely—from 5-40 gal. per ton of coal carbonized. Representative value was taken at 15 gal. Analyses from three plants averaged 647 ppm. BOD, 125 ppm. total suspended solids, 20 ppm. organic and $NH_3$ nitrogen, and 72 ppm. phenol.

A small amount of spent NaOH solution is discharged to the sewer during purification of light oil in the agitator. About 0.4 lb. of 95 percent NaOH is used per ton of coal carbonized daily.

Limited data from three plants indicated that the combined water influents, including cooling water, would



**DISTILLERY WASTES.** Evaporators at Seagram's, Louisville, Ky. Liquid residue after distillation is evaporated to sirup, then dried and sold.



**BYPRODUCT COKE WASTE.** Phenol is the villain here. Above, typical phenol recovery plant (Koppers process).

give a sewered population equivalent (BOD basis) of about 15 persons per ton of coal carbonized daily. Oxygen depletion by byproduct coke plants, while important, has not caused much complaint since most plants are located on relatively large streams. Phenols in small concentrations are detrimental to public water supplies: in the presence of chlorine, 0.002-0.005 ppm. might produce chlorophenol tastes and odors while 0.1 ppm. gives water a characteristic taste and odor of phenol. In higher concentrations, phenol is detrimental to fish life.

### How to Correct Them

Efforts to remedy byproduct coke plant pollution have concentrated on the phenol problem; recovery and removal units with efficiencies of 90-95 percent are in operation. Oxygen requirements can be reduced by about 50 percent by recirculating and reusing offending waters. Under favorable conditions, the value of crude phenol recovered about covers the recovery operating costs. Let's look at present disposal methods for each type of waste.

Sulphuric acid is used to wash the light oil to remove resins. The amount is small (1.6 lb. of 66 deg. Be. acid per ton of coal coked per day) and the waste is disposed of by dumping on slag piles. Dilute acid can be recovered by treating with steam. About 0.6 gal. of pure still residue per ton of coal carbonized remains in the bottom of the still after distillation; this is usually burned or dumped on slag piles. Condensate from benzene stills is contaminated with wash oil and benzene or light oil. The oil may be free or in water emulsion. Gravity separators are usually used to remove free oil. Oil in emulsion form is largely wasted to the sewer. Gravity separators (at the time of the study) could be installed for about $3,000 per 1,000 tons of coal carbonized daily.

Water used to quench incandescent coke is partially lost to the atmosphere as steam (about 125 gal. per ton of coal carbonized). Excess water can be disposed of by: (1) running to waste with the resulting loss of coke breeze; (2) collecting in a sedimentation basin, recovering coke breeze and running the rather clear supernatant liquid to the sewer; (3) reusing the clear liquor from the sedimentation basin with makeup fresh water for quenching, thus giving a closed system with no waste to the sewer. This system is practiced in many plants.

Water from the final coolers may carry considerable contamination. Some plants allow this effluent to run to the sewer, others recirculate it through cooling towers. A portion of the recirculated water may be used for coke quenching or it can be discharged to stream during high water. A material reduction in population equivalent and phenol content can be secured by converting to a recirculating system. A closed indirect cooler requires removal of napthalene to reduce stoppages but it does not discharge $H_2S$ as do atmospheric coolers.

Phenol can be recovered as crude phenol or sodium phenolate by: (1) the Koppers vapor recirculation process; (2) the benzene extraction process; (3) by absorption on activated carbon and extraction with benzene. The first two are well known and used in this country (hence not described here); the activated carbon method has been used commercially in Germany, evidently with varied success.

Phenols can be removed (but not recovered) and converted into nontaste and odor producing compounds by: (1) biological treatment; (2) coke quenching; (3) distillate coke quenching.

Biological filters or the activated sludge process will oxidize phenols if these are not present in sufficient quantities to have a toxic effect on the organism causing oxidation. Evidently 25-30 ppm. of phenol can be treated safely on a sand filter and 30-40 ppm. by the activated sludge process. Biological treatment of phenolic waste has been found generally uneconomical for individual byproduct coke plants because of the large treatment area required and the high dilution necessary for satisfactory operation. However, the waste can be satisfactorily treated in a municipal plant, provided there is sufficient dilution of domestic sewage, by activated sludge or on trickling filters. This method provides an economical solution at some plants.

One of the first commercial methods of treating phenol-bearing ammonia still waste was to use it for coke quenching. The method has distinct advantages: (1) complete evaporation of the waste; (2) use of heat that otherwise would be wasted. But it also has distinct disadvantages: (1) extensive corrosion to equipment by $CaCl_2$ in the waste; (2) poor appearance and odor of the coke for domestic purposes.

To take advantage of the coke quenching method and yet to eliminate high corrosion costs, the distillate quenching method was devised by one firm. Ammonia liquor is steam distilled in a regenerating column, the still vapors condensed and used at the quenching pit. The distillate contains the phenols and certain other volatiles; corrosive chlorides remain in the still and are continuously run to waste. The phenol odor of the coke was not objectionable since this was not sold for domestic consumption. This plant does not recover ammonium salts. About 95.1 percent of the phenol was removed from ammonia liquor containing an average of 1,052 ppm. phenol.

### Control or Be Controlled

Reading (and writing) between the lines, we here repeat our one conclusion in two parts: (1) all private originators of water pollution (whether industry, agriculture or service businesses) have much in common—basic characteristics of the wastes, problems of research, technique of treatment, and (2) the all-important common objective must be to eliminate as rapidly as possible the opportunities for that type of government (federal or state) interference and regulation that inevitably lead toward ultimate control. For control over your waste problems and processes can also mean control over your entire plant operations and economics. Such a state of control is already looming as a possible reality in more than one area of the United States.

**Average Wastes From Byproduct Coke Plants***

| | Gal. per Ton Coal Carbonized | BOD | Parts per Million: Total Susp. Solids | Parts per Million: Organic & $NH_3$ Nitrogen | Parts per Million: Phenol |
|---|---|---|---|---|---|
| Waste-carrying water: | | | | | |
| Ammonia still | 22 | 3,974 | 356 | 281 | 2,057 |
| Final cooler | 315 | 218 | ..... | 14 | 105 |
| Benzol carrying | 15 | 647 | 125 | 20 | 72 |
| Spent caustic | small | ..... | ..... | ..... | ..... |
| Cooling water | 3,200 | ..... | ..... | ..... | ..... |
| Not sent to sewer: | | | | | |
| Quench water | 125 | ..... | ..... | ..... | ..... |
| Spent sulphuric | small | ..... | ..... | ..... | ..... |
| Pure still residue | 0.6 | ..... | ..... | ..... | ..... |

* All figures vary considerably in the same and different plants.



Calco even has a weather station.

# Don't Throw Troubles To the Winds

**Air pollution is just as bad as stream pollution, says Calco. Here's how they keep their troubles to themselves.**

**V. L. KING and R. J. JENNY**

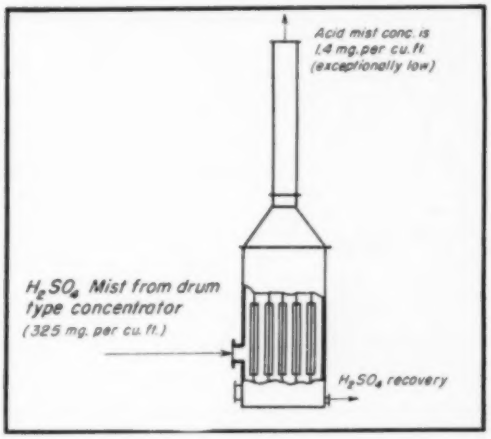
**Respectively, Technical Director and Industrial Hygiene and Safety Engineer, Calco Chemical Div. of American Cyanamid Co., Bound Brook, N. J.**

THE Bound Brook, N. J., plant of the Calco Chemical Division of American Cyanamid Co., involving over a thousand different chemical processes, has within itself many potential sources of air pollution. The development of air pollution prevention has more than one result. It not only produces an atmosphere which is pleasant to work in, but also saves many losses that otherwise would be incurred. The prevention of pollution of the air is a powerful aid to the control of industrial hygiene in which we are all concerned.

Management here has always maintained a conscious concern in trying to keep the atmosphere in and around the plant free from objectionable odors, vapors, mists, dusts, fumes and gases, and has for many years been carrying on a persistent and active program of air pollution prevention. We do not like to work or live in a polluted atmosphere ourselves, and we assume that our neighbors are just like us.

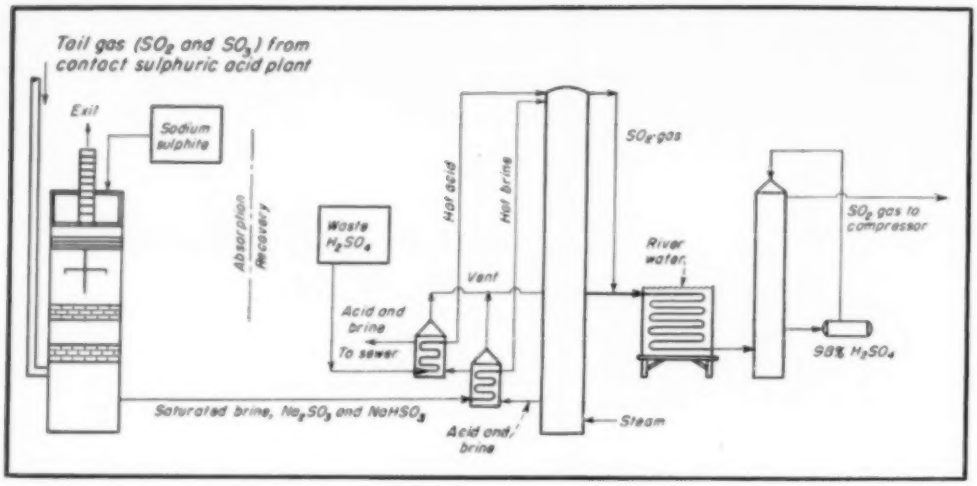
During the early period of growth, when many different manufacturing operations were being developed at Bound Brook, expansion was too rapid to digest all of the potential sources of air pollution that came with the manufacture of these many products. There was, therefore, a great deal of work involved in just catching up, and we would be the last ones to say that even at this date all our problems have been solved. We may never reach that condition, anyway, because some of the problems involved in making a manufacturing process completely innocuous from the point of view of polluting the atmosphere are so difficult as to require the most intensive and persistent investigation and research on the part of the ablest chemists and chemical engineers we can command.

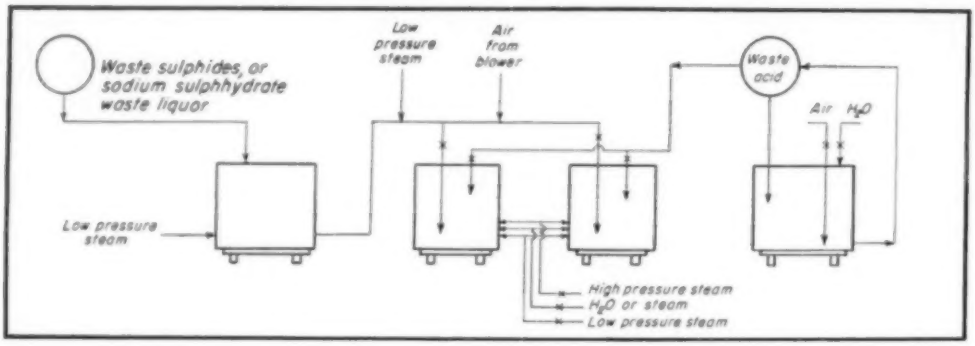
These notes are merely for the purpose of calling attention to our long and comprehensive program for the prevention of air pollution, and to report the progress so far made and to show that this kind of work must be continually in progress and a part of the regular occupation of manufacturing chemicals.

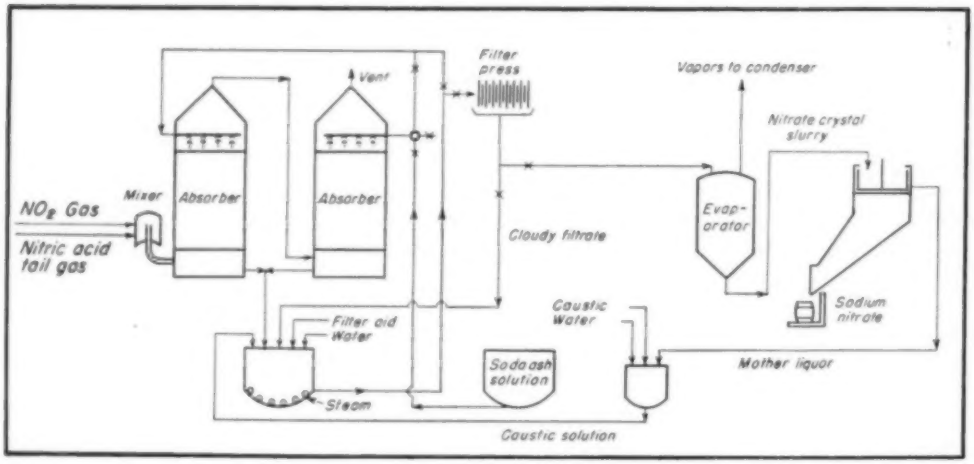



**MODIFIED COTTRELL PRECIPITATOR**
**With dome and stack, it stops 99% of acid mists.**

Great quantities of sulphuric acid are used at Calco in various operations such as in the manufacture of aniline, sulfa drugs, intermediates, rubber chemicals and dyes. Much of this acid being just dilute is recoverable and as such is concentrated in a drum type concentrator. The removal of water from the acid is accomplished by blowing air at a high temperature through the dilute $H_2SO_4$. The high temperature of the air and high velocity create an acid mist that would cause a most unpleasant noxious condition for miles around if it were not for the fact that a Cottrell precipitator is placed at the exit to catch this acid mist by electrical precipitation. Not only has it been an aid in suppressing a cause of air pollution but it has shown a sizable recovery of sulphuric acid. At times, however, especially during peak loads, the capacity of the precipitator may be exceeded. Under such conditions, a small amount of fine mist may pass on through the precipitator. Our Cottrell precipitator outlet has been modi-


Tail gas ($SO_2$ and $SO_3$) from contact sulphuric acid plant
Exit
Sodium sulphite
Absorption
Recovery
Waste $H_2SO_4$
Hot acid
Hot brine
$SO_2$ gas
Vent
River water
$SO_2$ gas to compressor
Acid and brine
To sewer
98% $H_2SO_4$
Saturated brine, $Na_2SO_3$ and $NaHSO_3$
Acid and brine
Steam


Waste sulphides, or sodium sulphhydrate waste liquor
Low pressure steam
Air from blower
Waste acid
Air
$H_2O$
Low pressure steam
High pressure steam
$H_2O$ or steam
Low pressure steam


Filter press
Vent
Vapors to condenser
Nitrate crystal slurry
$NO_2$ Gas
Nitric acid tail gas
Mixer
Absorber
Absorber
Cloudy filtrate
Evaporator
Sodium nitrate
Caustic Water
Filter aid Water
Soda ash solution
Mother liquor
Steam
Caustic solution

fied to take care of high wind velocities which tend to overload the electrode banks on the opposite side to the wind direction. We increased the effectiveness of the Cottrell by installing a dome and a stack on the top of the precipitator. A percentage of reduction of acid mist as $H_2SO_4$ is presently 99 percent as compared to a range of 85-95 percent before the dome and stack were installed in the plant.

## $SO_2$ ABSORPTION AND RECOVERY

**Sodium sulphite gets all but a trace under control.**

In the manufacture of sulphuric acid by the contract process, not all the $SO_2$ is converted to $SO_3$. The unconverted $SO_3$ after passing through the contact absorbers is further absorbed with a sodium sulphite brine which is partially converted to sodium bisulphite. The $SO_3$ is later sprung from the sodium bisulphite and recovered (top flowsheet at left). Our final exit in the contact process contains 2 mg. per cu. ft. of mist as $H_2SO_4$ and 8 mg. per cu. ft. as $SO_2$. This is considerably lower than the exit gases and mist of the standard contact plant which emit approximately 20-25 mg. per cu. ft. of mist as $H_2SO_4$ and 200 mg. per cu. ft. as $SO_2$. A 20 percent increase over the rated capacity of $H_2SO_4$ from 160 tons per day to 190 tons per day could double the volume of the visible fog beyond the exits. Temperatures in the neighborhood of 50 deg. C. and concentrations between 96.8 and 97.0 percent $H_2SO_4$ by weight seem to give the best results, and a close temperature control must be maintained here to prevent pollution of the atmosphere by $SO_2$.

## WASTE SULPHIDES PRE-TREATMENT

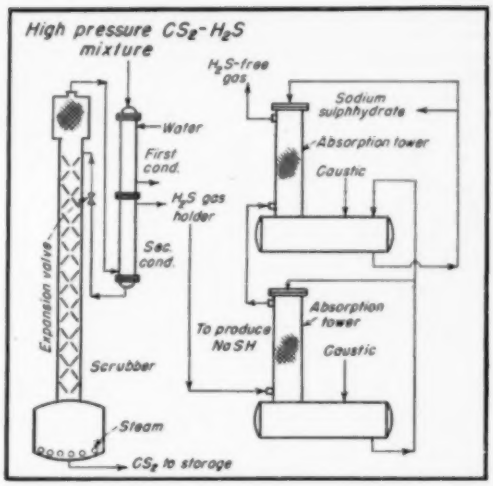
**Unless they're "fixed," an acid effluent may regenerate $H_2S$.**

When sodium sulphydrate formed from the reaction of $H_2S$ with caustic (see story next column) is contaminated, and not used in the plant, it must be disposed of in the effluent. If it were mixed with the bulk of the Calco effluent, which is acidic, the $H_2S$ and odors would be regenerated and would pollute the air all over again. To avoid this, these impure sulphydrate liquors are collected from various air pollution prevention scrubbers and given an aeration to fix the $H_2S$ and odor liberating compounds as thiosulphates. The resulting liquors are then treated with waste sulphuric acid and heated to drive off recoverable $SO_2$ and precipitate sulphur. The sulphur can be settled and may be reused again. This treatment at the source destroys the possibilty of regenerating the absorbed $H_2S$ in the effluent. In this operation the oxygen consuming power of the effluent is also reduced from several hundred thousand to two or three thousand parts per million and almost all the color removed as well.

## $NO_x$ ABSORPTION AND RECOVERY

**Not 100% but the reduction is substantial.**

The production of nitric acid by catalytic oxidation of ammonia involves certain losses of nitrogen oxide gases due to incomplete oxidation and absorption. These gases are toxic, and due to their pronounced yellow-orange color, create a bad visual effect. Calco's method of handling these gases is to absorb them in soda ash to form sodium nitrite. The efficiency of this absorption is not 100 percent but a very substantial reduction in the amount of escaping gases has been accomplished and with some economic return from the manufacture of sodium nitrite.




## HYDROGEN SULPHIDE SCRUBBER

**Takes out $CS_2$, leaves $H_2S$ fit for use.**

In the making of mercaptobenzothiazole, a mixture of hydrogen sulphide and carbon bisulphide and some COS is evolved. These could be bad air polluters and both $H_2S$ and $CS_2$ are valuable chemicals worth recovering. Considerable time and money were spent in the successful development of the low-temperature combination condensation and stripping column shown above; it scrubs the carbon bisulphide as a liquid from the hydrogen sulphide, the latter leaving the scrubber with only traces of carbon bisulphide present. The carbon bisulphide is reused as such and the hydrogen sulphide is used for two further purposes: to produce calcium or (as illustrated in the drawing) sodium sulphydrate used in other processes at Calco, or to convert cyanamide into thiourea, which is an essential intermediate in the manufacture of sulphathiazole, one of the sulphonamide drugs. If this hydrogen sulphide had not been available for the thiourea process, it might at times have been difficult to obtain enough thiourea for the manufacture of sulphathiazole. And, if this mixture of hydrogen sulphide and carbon bisulphide had been allowed to go to the atmosphere, the latter would have been badly polluted, and we would have lost the value of these by-products.

Where the $H_2S$ is in a dilute form (3.0 percent by volume) in air, as there are no known materials for extracting $H_2S$ as such unchanged from air, and the absorption of dilute $H_2S$ with caustic is also more expensive, care must be taken to build scrubbers that really stop the odors. Frequently there occurs with waste $H_2S$-air mixtures, obnoxious odors other than $H_2S$. These residual odors accompanying $H_2S$ are not always absorbable in caustic. Some of these odors can be successfully absorbed in a concentrated sulphuric acid scrubber; however, the gases being of 100 percent relative humidity, the acid would have to be maintained at close to 150 deg. C. to prevent dilution and hydrolysis. This is undesirable both from a safety and a construction angle. Sodium hypochlorite has been found to destroy some of these residual products. The problem of $H_2S$ absorption from air into caustic is a difficult one from the design viewpoint inasmuch as very little basic technical information, such as the absorption coefficients with various caustic concentrations, has been published and because

of the residual odors which must also be suppressed. However, much can be done with the caustic alone by adjusting its strength, temperature and other operating conditions.



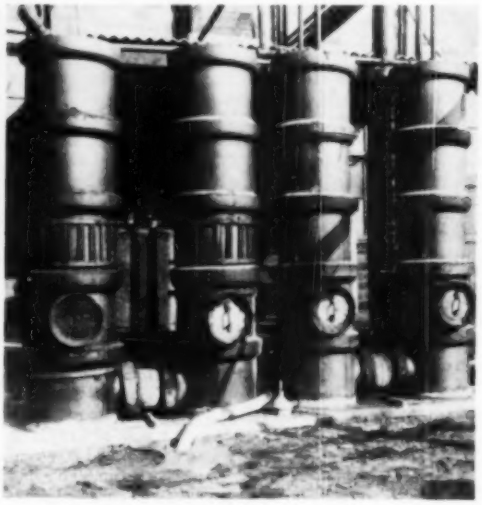
**FLY ASH COLLECTORS**
**Retrieve 4,000 tons, 70 percent of it carbon.**

The atmosphere may also be polluted by smoke and fly ash from the power house that produces steam and power. Smoke can be disposed of very briefly by stating that all of the power is generated by combustion of small sizes of anthracite coal on chain grate stokers, with such a high degree of combustion efficiency that there literally is no smoke. However, there is a considerable fly ash problem which is not only a nuisance but involves financial loss in that about 70 percent of the fly ash is carbon or coal. This situation is now well in hand through the use of Multiclone dust collectors with an ingeniously designed return system which blows the collected ash and coal back into the furnace, resulting in almost complete combustion of the coal and rejection of the ash only. All of Calco's boilers have fly ash collection systems and these systems have been converted to the return type which saves the carbon. At present this effects a removal of about 4,000 tons of fly ash each year.

**ANTHRAQUINONE GAVE TROUBLE**
**Then a vent was eliminated; an absorber was built.**

In the sulphonation of anthraquinone with oleum, mercury used to be sprayed into the sulphonator. The venting of the air used in spraying the mercury resulted in considerable $SO_3$ fumes. By eliminating the spraying of mercury and using a suitable non-volatile mercury compound instead, it was not necessary to vent the reaction vessel as no air was added to spray liquid mercury. Air pollution was eliminated.

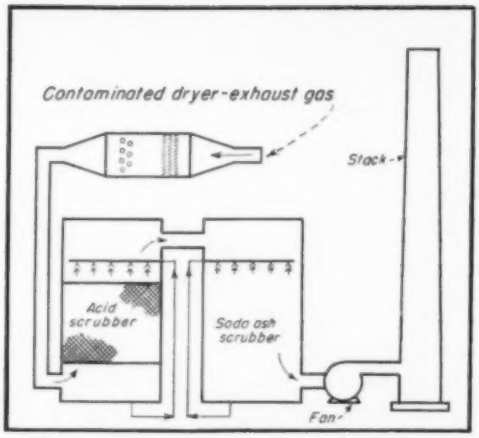
Air may also be polluted by dusts. The elimination of dust originating from the processing of various products is an integral part of our air pollution prevention program. In one operation, the manufacture of anthraquinone, a very unpleasant dust atmosphere was created by the sublimation of the anthraquinone. While this dust did not get out of our own grounds and barely out of the building in which this operation was carried out, it was unsatisfactory as an atmosphere in which to work, and after some very considerable engineering investigation, an installation was built which thoroughly absorbed this dust, so that at the present time, and in fact for many years now, the production of dust has been completely eliminated and a much more pleasant and satisfactory operating condition created. Adequate, well-designed exhaust systems with filters have also proved effective in improving working conditions.



**HCl AND OTHER SCRUBBERS**
**It takes a lot of them—strategically located.**

The evolution of hydrochloric acid gases in such quantities and concentrations that they do not support economic recovery, is another example of an extensive yet more simple problem of air pollution prevention. These HCl gases are emitted from the manufacture of many different chemicals, and there are 14 separate water scrubbing systems required for the suppression of this nuisance alone. The scrubbers are towers of earthenware sections, coke or ring packed, wherein the HCl gas is washed with water, and the water-absorbed acids sent to the sewer and subsequently neutralized in the effluent treatment plant. The photograph shows a typical tower installation for absorbing gases like ammonia, chlorine, nitric oxide, and phosphorus oxychloride, to mention a few.

While the design and operation of these scrubbers are simple and well known, the location of the scrubbers over a large plant area and the necessity of neutralizing the effluents involve an undertaking of considerable size and importance. The removal of acid gases and mists is important in eliminating fogs caused when there are simultaneous leaks into the atmosphere of ammonia or ammonia-like substances and acid gases or vapors. For example, aniline and $H_2S$ will create a fog just as ammonia and $SO_2$.




**DEODORIZING SYSTEM**
**Mercaptans ended, but the malodor lingered on.**

In contrast to the technically simple matter of absorbing gases like hydrochloric acid out of air into water, a much more difficult problem may be cited, namely, the suppression of very minute quantities of benzothiazole in large volumes of dryer discharge air. This problem occurred during the adoption and development of a process for manufacturing mercaptobenzothiazole, a rubber accelerator. When the plant was put into operation, the exhaust air from dryers became the source of a very offensive odor of exceptional staying power even in a brisk wind. As mercaptobenzothiazole is a mercaptan, and belongs to a family of chemicals nearly all members of which are noted for their unpleasant odor, it was natural to assume that the cause of the odor was also a mercaptan. On this basis our best chemists and engineers worked for nearly two years, trying many schemes, any one of which would have destroyed any mercaptan. Also, outside engineering corporations experienced in odor suppression were brought in and they built equipment at considerable financial loss to themselves in futile efforts to find a satisfactory solution. Only after the most persistent and determined work did we finally ascertain that the true source of the odor was not a mercaptan at all, but a base, benzothiazole. The difficulty of arriving at this conclusion can be appreciated when it is realized that at this time there was something less than a pound of benzothiazole in one-hundred thousand cubic feet of air. When, however, about a quarter of a pound has been successfully isolated from the air, chemical analysis showed it to be benzothiazole, a base and not a mercaptan.

As soon as it had been established that we were dealing with a product whose predominating characteristics were those of a base and not those of a mercaptan, we were able to review the work we had already done with acids as absorbers. While benzothiazole combines with acids as it should, we found that the combination is readily hydrolyzable by water and that unless the strength of the acid were maintained above a certain level by keeping water out of it, this hydrolysis could defeat our efforts as it had when acids were first tried. As the air from dryers is very wet, it was necessary to prevent this water from diluting and weakening the acid to a point where the benzothiazole-acid combinations might be hydrolyzed. This was accomplished by heating the absorbing acid to the point where it maintained a partial vapor pressure equivalent to that of the water-laden air entering the scrubber from the dryers. By careful analysis of the absolute humidity of the dryer exhaust air, which varies with any change in humidity of the atmosphere entering the dryer, it was possible to regulate the temperature of the acid so that there was practically no gain or loss in moisture content. It was found that a temperature of something over 45 deg. C. would keep the acid above 1.550 specific gravity (at 20 deg. C.) or about 64 to 65 percent strength, while if the acid strength were allowed to approach a lower limit of 50 percent, excessive hydrolysis of the benzothiazole-acid combinations could take place. We have found the benzothiazole to inhibit corrosion, and as its concentration in the acid solution increases to about 30 percent, the total sulphuric acid content may be allowed to drop to 55 percent without corrosive damage to mild steel. It was feared that a certain small amount of mist might be carried out of the exhaust stack of the acid scrubber, so a second scrubber, packed with coke and sprayed with a soda ash solution, is used at the exhaust of the acid scrubber. The sodium carbonate solution travels parallel, or co-current, with the exhaust gases and any acid spray neutralized, thereby preventing any entering the fan and final exhaust stack. This system has been operating very successfully since the fall of 1939. The two scrubbers handle at their peak about 30,000 cu. ft. of dryer air per minute, or 43,200,000 cu. ft. per day, removing about 350 lb. of benzothiazole per day with a weekly consumption of 8,000 to 10,000 lb. of spent or waste 70 percent sulphuric acid and 300 to 350 lb. of soda ash.

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**THE CALCO FORMULA**
**Eternal vigilance; willingness to pay the price.**

For some time a study was made of atmospheric pollution in our plant and in the surrounding neighborhood by means of a specially constructed traveling laboratory. This mobile laboratory was a station wagon in which was compactly assembled 80-odd pieces of analytical apparatus. It operated for many months, 24 hr. a day within a ten mile radius of the plant, studying all types of air contaminants which might or might not emanate from Calco. Much valuable experience and data were obtained. However, it is difficult to surpass the ability of the human nose by any apparatus yet devised.

A weather station is maintained at Calco, recording continuously wind direction and velocity, atmospheric temperature, relative humidity and barometric pressure. Frequency of the prevailing winds has been charted and records continuously kept.

The foregoing brief descriptions of a few specific installations to prevent atmospheric pollution make no mention of the initial or operating costs involved, but the following brief summarization of the major expenditures may be of interest.

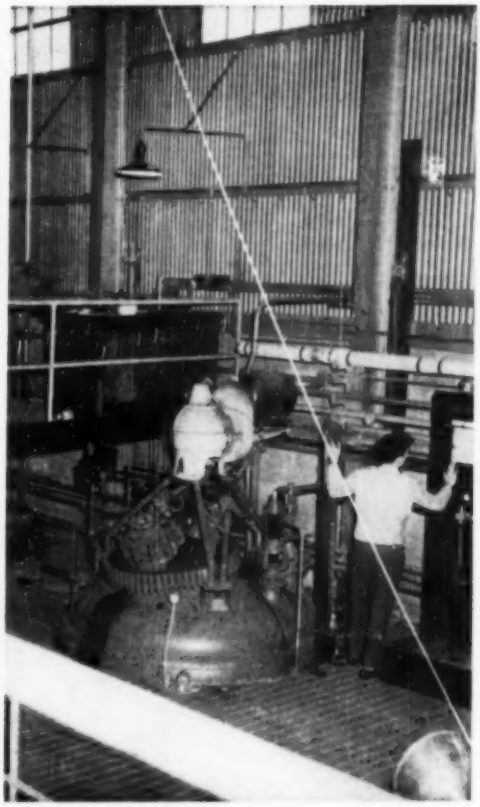
Calco has spent over $700,000 in the last ten years in the cost of over 200 installations for the suppression of air polution, and much more has been spent in developing the processes. Plans for continued expenditures of this kind, running into several hundred thousand dollars, are already developed and being carried out. It also costs money to operate these absorbing systems; at the present time we are handling something like 50,000 cu. ft. of various gases per minute and using nearly 1,000 tons of solid and liquid chemicals each year at a cost, for chemicals alone, of something in the neighborhood of $35,000, not to mention the cost of labor and supervision.



PICKLE LIQUOR IS HEADACHE. Obnoxious in streams, its ferrous sulphate content is raw material for new process.



ZINC WASTE HAS LITTLE VALUE. Before, skimmings from galvanizing tanks were sold at fraction of their zinc value.



REACTOR IS HEART OF PROCESS. Here $FeSO_4$, ZnO and Cl react to form slurry containing three products shown at right.

New process takes these two wastes . . .

. . . Reacts them under controlled conditions . . .

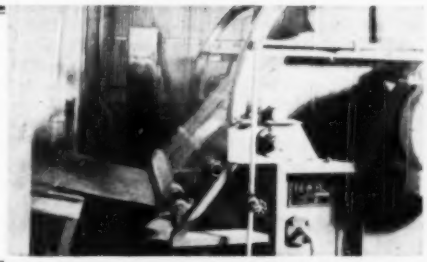
# Dispose of Pickle Liquor at a Profit

This is a new process. Its description can be followed more easily with the help of the fold-out pictured flowsheet, pp. 144-147.

**Harry Kraiker, Jr.**
Consulting Chemical Engineer
Philadelphia, Pa.

ALMOST all steel mills have a pickle liquor disposal problem. Steel is cleaned in strong hot solutions of sulphuric acid. In cleaning the steel the acid dissolves iron. The resulting solution of ferrous sulphate is very difficult to dispose of. The states are insisting that it shall not be dumped in the streams. The conventional way of disposing of this spent pickle liquor is to neutralize with lime but this is very costly and there still remains the problem of getting rid of the sludge that results.

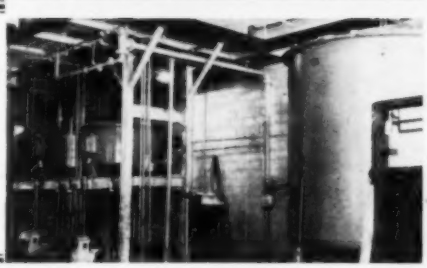
At the Wheatland Tube Co.'s plant at Wheatland, Pa., there is a new $500,000 plant converting pickle liquor into three salable products—ferric hydrate, zinc sulphate and zinc chloride. This is a profitable operation. A separate company, the Maneely Chemical Co., was organized to operate this new chemical plant and to



**FERRIC HYDRATE IS FILTERED OUT**
String-discharge, rotary vacuum filter takes up $Fe(OH)_3$ precipitated in reactor. Hydrate is flash dried and sold.



**ZINC SULPHATE CRYSTALLIZES OUT**
Evaporator - crystallizers and horizontal filter (on platform) recover $ZnSO_4$. From filter crystals go to rotary dryer and the customers.



**ZINC CHLORIDE STAYS IN SOLUTION**
Bottom of evaporator-crystallizers from which flows $ZnCl_2$ solution, ready for sale, to storage tank in foreground.

**. . . And turns out these three salable products.**

sell the output. Into this new chemical plant come three raw materials—spent pickle liquor, chlorine and zinc waste.

The first waste is the necessary evil of pickling steel pipe. Steel pipe must be pickled before it can be galvanized. This spent pickle liquor has a negative value. It contains 21 percent ferrous sulphate and ½ percent free sulphuric acid. From the galvanizing shops it flows by gravity through tile pipes into a small sump. From here an automatic self-priming Duriron pump moves the liquor into a 24,000-gal. concrete storage tank lined with acidproof brick. A second self-priming Duriron pump delivers into the chemical plant as needed.

The second raw material is liquid chlorine, received in tank cars. The vapor pressure of the chlorine is used to force the liquid chlorine into the plant. Here in a chlorine evaporator hot water converts the liquid chlorine to a gas.

The third raw material is zinc waste, also a byproduct of galvanizing steel pipe. The two zinc wastes used in this plant are known in the galvanizing trade as sal skimming and raw ash. These are mixtures of metallic zinc, zinc oxide, zinc chloride, ammonium chloride and iron. These two normally sell for only a fraction of their zinc value. It is this low price for zinc value that makes the Wheatland plant profitable. Every pound of zinc that enters leaves either as zinc chloride, zinc sulphate, or as metallic zinc. In fact all three of the raw materials end up as salable products. The iron of the ferrous sulphate in pickling acid reappears as the iron pigment, ferric hydrate. The suphate of pickle liquor furnishes the sulphate radical for the zinc sulphate. The chlorine appears as the chloride radical of zinc chloride.

Before the zinc waste can be used in the process it must be converted into zinc oxide. This zinc oxide need not be pure; its color, in fact, is more a dirty yellow than pure white.

To prevent any zinc oxide dust from contaminating other sections of the plant, the zinc waste is processed in a separate room 100x30x35 ft. high. Outside, at one end of this room, there is a concrete receiving hopper wherein trucks dump their loads of zinc waste. The waste slides through an opening in the wall into a bucket elevator that carries it into an overhead steel storage bin. From this bin it passes over a permanent magnetic drum to remove any tramp iron. The zinc waste flows by gravity into a gyratory crusher.

In this crusher lumps of zinc waste that may be as large as 4 in. are reduced in a single pass to less than ½ in. But the metallic zinc pellets contained in the zinc waste are flattened out into disks, while the non-metallic portion is reduced to a powder. This crushed material is now carried by a bucket elevator to a double-deck vibrating screen mounted on top of a steel tower. Here the metallic zinc disks are screened out and the balance discharged into a roller mill. Any pellets of zinc that were small enough to pass through the first vibrating screen are further flattened out in a roller mill and screened out by a second vibratory screen. The flattened metallic pellets of zinc flow in a collecting chute into a steel bin. A chute discharges these metallic disks through an opening in the wall directly into a truck. These pellets are sold to zinc smelters to be melted down into slabs.

The non-metallic portion is fed into a 4 by 60 ft. kiln wherein it is calcined to zinc oxide. The kiln is provided with a variable speed drive so the speed of rotation of the kiln can be controlled. By regulating rotation, the length of time the material is in the kiln can be controlled. The kiln is also equipped with an emergency gasoline engine to operate the kiln in case the normal electric power should fail. This is necessary because if rotation were stopped while it was hot, the kiln might warp. The gasoline engine has a sprocket at one end of its drive-shaft to drive the kiln, while an electric generator directly connected to the other end of the engine drive shaft furnishes power for such necessary auxiliaries as fans and lubrication pumps.

The calcined zinc waste discharges through an opening in the floor into a

vibratory cooler mounted in a concrete pit. This vibratory cooler consists of a jacketed, water cooled stainless tube 14 in. in diameter and 5 ft. long. To increase the strength of the tube and to provide more cooling surface the inner tube is corrugate lengthwise. Because of the lack of room for other type drives it was decided to propel the hot impure zinc oxide through the cooler by means of vibration. A vibrator is mounted on the tube so the whole tube, the flowing cooling water, and th hot zinc oxide are all vibrated. The use of the vibrator eliminates the need to protect against heat any moving part in direct contact with hot zinc oxide. The zinc oxide enters the cooler at about 1,400 deg. F. and leaves at 600-700 deg. F. A simple rheostat controls the strength of the vibration, thus giving excellent control over the rate of flow of the hot zinc oxide through the cooler. To increase cooling, all secondary air for combustion is blown through the inner tube in direct contact with the hot zinc oxide. *(Note: this cooler is new in some of its details; an article describing it will be published soon.—Editor.)*

The cooled zinc oxide is carried by another bucket elevator into another steel storage bin. From this bin it flows by gravity into a Raymond air-swept pulverizer. Here it is hammermilled to about 100 mesh. The classifying air stream carries the ground zinc oxide up to a cyclone on top of a steel tower. From here it flows into a surge bin. This surge bin feeds a screw conveyor which carries the finished zinc oxide through the brick wall to the wet process room. This screw conveyor has a variable speed drive because it also acts as a proportioning feeder for a slurry tank in the wet process room. All the preceding equipment is for the sole purpose of converting the zinc waste into impure zinc oxide to be used in the disposal of pickle liquor.

### Dust Free, But *Free*

One of the noteworthy features of this zinc oxide room is that all the equipment is totally inclosed. From the time the zinc waste enters this room through the opening in the brick wall until the finished impure zinc oxide is conveyed out of the room through the other wall opening into the wet processing room it is completely housed in dust-tight equipment and chutes. It passes through four bucket elevators, five bins, gyratory crusher, roller mill, two vibrating screens, rotary kiln, vibratory cooler, belt conveyor, pulverizer, and screw conveyor—and at no time can the operator see the zinc waste without opening an inspection port.

To further lessen any chance for dust's escaping into the room, all parts of the equipment are under suction. Exhaust gas from the kiln contains large quantities of zinc oxide, so it must be filtered before it can exhaust into the atmosphere. But the gas is too hot to be filtered through cotton bags so it is cooled by bleeding in cool air. Instead of just taking the cooling air from the room, ducts are provided for drawing air from all portions of the equipment. Thus, two birds with one stone: cooling of the kiln gas and suction on dust-producing exquipment.

### Wet End

In the center section (60x100x36 ft. high) of the chemical plant the actual treatment of the spent pickle liquor takes place. The pickle liquor is pumped directly from the 24,000 gal. storage tank into one of two 2,000 gal. glass-lined reactors. Here it is heated to about 185 deg. F. Sufficient zinc oxide is added while the solution is being agitated to neutralize the free acid and to raise the pH to about 5. Sufficient air is drawn into the solution by the agitation to cause a small amount of ferrous iron to oxidize to ferric. This is precipitated as ferric hydrate floc by the high pH. This floc gathers up most of the impurities in the pickle liquor. The slurry is pumped directly into a Monel rotary vacuum filter equipped with strings to discharge the filter cake. This filter cake of insoluble waste is discarded. While the content of one of the 2,000 gal. reactors is being pumped into the filter another batch is being prepared for filtering in the other reactor.

The filtrate, which is no longer pickle liquor but is a solution of ferrous sulphate, is pumped into a 3,000 gal. glass-lined holding tank. From here 1,500 gal. of the solution is pumped into a third, and main, 2,000 gal. glass-lined reactor. This reactor is specially made for this chlorination service. Any plugs in the glass lining are tantulum; gold would not resist free wet chlorine. The agitator has a Hastalloy-C sleeve and Teflon packing. All the gaskets on this unit are Teflon.

The solution is heated in this special reactor to about 220 deg. F. Zinc oxide and gaseous chlorine are added simultaneously while agitating. The agitation of this reactor was especially designed for the best gas absorption. The rates of addition of both the zinc oxide and the chlorine are carefully adjusted to keep the pH in the desired range. The addition of zinc oxide tends to raise the pH while the addition of chlorine drives it down. The pH has a great effect on the shade of the pigment (ferric hydrate) produced.

In case chlorine pressure should build up in the space above the liquid in the reactor, there is a glass-lined pop safety valve to vent it into a solution of ferrous sulphate where it will be absorbed. The chlorine is added to the batch through a bottom diffuser valve. The glass-lined valve is similar to a pop safety valve but assembled in reverse.

### Why Slurry

The addition of 3,000 lb. of zinc oxide to a closed reactor presented a problem. There seemed to be no way of adding dry zinc oxide without permitting chlorine gas to escape. It was decided to add the zinc oxide in the form of a slurry. A solution of zinc salts from a later step in the process is used to avoid the necessity of evaporating extra water. Zinc oxide powder is fed continuously into a 1,000 gal. Monel tank; this screw conveyor feeder from the zinc oxide room is adjusted to the flow of zinc salts solution into this tank so as to keep a uniform strength slurry. The zinc salts solution is pumped out of the holding tank just preceding the evaporators. To prevent the zinc oxide from settling out and caking, the slurry tank is kept constantly agitated. To prevent the zinc oxide from caking in distributing pipelines, it is constantly circulated through a loop of Monel pipe that runs out past the reactors and back to the slurry tank; short "spur" lines connect each reactor to the loop.

There is no pH electrode that will withstand the temperature inside the reactor. Therefore arrangements had to be made to withdraw a sample, cool it, and return it to the reactor. An extra valve was placed in the bottom of this glass-lined reactor. A small Hastalloy-C pump continuously withdraws a sample from this bottom valve through a water cooled Hastalloy-C coil, through a glass pH chamber and back into the reactor.

The reaction in the reactor is as follows:

$$2FeSO_4 + 3ZnO + Cl_2 + 3H_2O \rightarrow 2ZnSO_4 + ZnCl_2 + 2Fe(OH)_3$$

The last trace of iron is precipitated out as insoluble ferric hydrate in a little less than 3 hr. When titration shows no trace of iron the solution is ready to be filtered. But before the manhole in the top of the reactor can be opened a Duriron ejector pulls a suction on the space in the reactor above the liquid. This prevents the escape of chlorine into the room. The liquid used in this ejector is a solution of ferrous sulphate from the hold tank just preceding the main reactor. This solution absorbs the chlorine and

utilizes the oxidizing power of the chlorine. This is another example of the care used in handling chlorine.

From this main reactor the batch is pumped into a 3,000 gal. glass-lined storage tank. It is kept constantly agitated to prevent the ferric hydrate from settling. This slurry is 220 deg. F. as it enters this tank. The tank is painted black to help lose sufficient heat to allow the slurry to be filtered in a vacuum filter. From the storage tank the slurry is pumped through a standpipe classifier; the linear velocity of the slurry moving upward in this standpipe is adjusted so that any coarse particles will settle out but the fine particles of ferric hydrate will be kept in suspension. Overflow from the standpipe goes to a second Monel vacuum filter. Here the ferric hydrate is filtered out and washed free of zinc salts. The washed filter cake is discharged by strings directly onto a 4-ft.-wide belt conveyor that carries it through an opening in the wall into a third room, the ferric hydrate room.

### Zinc Salt Saga

The filtrate, which is free of iron and which contains approximately 2.4 lb. of zinc sulphate and 1 lb. of zinc chloride per gallon, is pumped through a Monel polishing filter. Here the pre-coat of filter-aid removes the last trace of precipitated ferric hydrate. This solution of zinc salts is pumped through an upright Monel pipe 10 in. in diameter and 5 ft. high. This pipe is packed with activated carbon and fine metallic zinc dust. The activated carbon removes any dissolved organic matter. The zinc dust "cements out" any metal above zinc in the electromotive series, including any iron a careless operator might allow to slip by the chlorination reactor.

This purified solution is pumped into a thousand gallon glass-lined storage tank. A portion of this zinc salt solution is pumped to the zinc oxide slurry tank. The balance is pumped into a Monel double-effect vacuum evporator-crystallizer. In the first effect the solution is concentrated by the evaporation of approximately 3 lb. of water per gallon of solution. In the second effect (27½ in. of vacuum) still more water is evaporated and almost all of the zinc sulphate crystallized out. The separation of zinc sulphate and zinc chloride by fractional crystallization is very sharp due to the extreme solubility of zinc chloride. Zinc chloride is soluble to the extent that 646 parts of zinc chloride will dissolve in only 100 parts of water. Zinc sulphate is only soluble to the extent of 80 parts in 100 parts of water. It is almost possible to crystallize out 100 percent of the zinc sulphate before the first trace of zinc chloride crystallizes. The slurry from the salt collector of the crystallizer is pumped to an Oliver horizontal filter mounted 26 ft. above the floor. The mother liquid, which contains approximately 68 percent zinc chloride and only 2 percent zinc sulphate, is pumped into a Monel holding tank. The washed and dewatered crystals of zinc sulphate spill into a Monel, directly heated, rotary kiln type dryer 30 ft. long and mounted 15 ft. above the floor. This dryer discharges directly into Monel storage bins. From these bins it goes into 100 lb. bags for sale. The dewaterer and dryer are mounted high so as to secure a gravity flow from the dewaterer to the bags.

The mother liquid from the second effect crystallizer is accumulated in a 2,700 gal. Monel tank until there is sufficient to start up another Monel evaporator-crystallizer, this one only single-effect. Here the balance of the zinc sulphate is crystallized out along with a small percentage of zinc chloride. These mixed salts are redissolved in the zinc oxide slurry tank. The zinc chloride solution, which now contains 70 percent zinc chloride, is pumped into a 3,000 gal. glass-lined storage tank. It is ready for sale. While it is a water solution it contains more solids (70 percent) than many salts. It is sold either in special drums or tank cars.

The keynote of the wet process is resistance to chemical corrosion. All the process piping is Monel; all the equipment is either glass-lined or Monel. The pipelines and equipment associated with the chlorination reactor presented a special problem. Hastalloy-C was used where glass or glass-lined could not be used. All the gaskets and most of the packing are Teflon. Wet chlorine and ferric chloride are very difficult materials to handle.

Of the thousands of gallons of pickle liquor that enter this new chemical plant none will enter the streams. The condensed distillate from the evaporators will be collected and returned to the galvanizing shops for making up new batches of sulphuric acid pickling solutions. This reuse of evaporator condensate will tend to keep the calcium and sodium contents of the zinc salts low.

### Back to Hydrate

The ferric hydrate filter cake that was discharged onto the belt conveyor is carried through the opening in the wall to a separate room called the ferric hydrate room. This room is separate to prevent the rest of the plant from being contaminated. Ferric hydrate is dried in a Raymond flash drying system. Here hot air from a furnace and the moist filter cake meet in a hammer mill. The air stream carries the dried ferric hydrate up to a cyclone where most of the ferric hydrate is removed from the air. The air from the cyclone is completely cleaned in a cotton bag type dust filter. The hot gases that enter the dust filter are almost saturated with moisture. The room temperature is well below the dew point of the hot gases in the dust filter. To prevent moisture from condensing out on the relatively cool metal side of the dust filter, an inclosure was built completely around the dust collector. The clean but still hot air from the dust collector is blown back into this space surrounding the dust filter. Thus the dust collector is kept warm and condensation prevented.

The dried ferric hydrate is fed into a steel bin from which it is withdrawn for bagging. The principle use for ferric hydrate is as a pigment or as a gas absorbant.

Again, as in the zinc oxide room, the equipment is completely inclosed and under suction. There is even a suction hood around the valve that feeds the ferric hydrate into the bags. This extra air is used to cool the air from the cyclone down to a temperature where it can safely enter the dust collector.

The whole plant was designed to be as automatic as possible and to use as little manpower as possible. Natural gas is the principle fuel but the boilers, dryers, kilns, and space heaters are all arranged to use oil as a substitute fuel. The plant can operate 100 percent on either fuel.

This is a long and complicated chemical process just to dispose of a waste. But it must be recognized that most industrial wastes are chemicals of low market value. The best way of disposing of these unwanted chemicals is to convert them into marketable products. There is no "royal way" to waste disposal—no panacea for all problems. The first step toward solving waste problems is to develop a real will to do something about them.

It took courage for the Wheatland Tube Co. to invest a half million dollars in a field so foreign to its experience. But the Wheatland Tube Co. really wanted to do something about its pickle liquor problem, so they built this chemical plant to take "second hand acid" and "second hand zinc" and make marketable products from them.

# Atomic Wastes

***Chemical Engineering* reports on the United States Atomic Energy Commission's seminar on disposal of radioactive wastes.**

■ HOT ATOMIC WASTES—how do you dump them without killing everything in the area with deadly radiation? In answer, the Atomic Energy Commission held a two-day seminar attended by 55 sanitary engineers and government representatives to familiarize them with the problems involved. Further, AEC hopes to get some helpful suggestions from the outside world.

Here are some of the conclusions to be drawn from this, the first of what AEC hopes will be a series of such "co-educational" sessions: (1) Bombardment by heavily-charged particles is the only way to induce radioactivity. Merely being near an active substance won't necessarily do the trick. (2) Where there is radioactivity, there is no chemical or physical means of getting rid of it. You either wait for it to die away, dilute it, or isolate it somewhere — preferably underground. (3) One method of solution involves hitting the problem at the source—better planning and insulation, and thus fewer "hot" wastes. (4) Pure disposal can be satisfactorily handled by proper application of conventional equipment and procedures.

On the basis of the seminar, here's how AEC is currently disposing of useless radioactive byproducts of the atomic industry. Briefly, wastes of relatively low intensity with short half-lives are diluted, stored a short while, and then released into the even greater dilution of a river or the free atmosphere. Particularly "hot" and long-lived wastes can only be buried. Problems are how to separate active substances from re-usable or easily disposable materials and to concentrate the radioactive wastes into the smallest possible volume.

Large amounts of water and air used in cooling nuclear reactors account for by far the largest volume of waste. But except for occasional traces of carbon 14 (half-life, 5,100 yr.) most radioisotopes found in these coolants are short-lived. Half-life of radio-argon is 110 min.; iodine, 8.3 days; phosphorus, less than three weeks.

However, both gaseous and liquid wastes in less volume but often intensely active, come from other sources such as chemical separation, material processing, metallurgy, machining, incineration and laboratory research.

Fumes, mists, and gases are ventilated, scrubbed, and filtered, concentrations collected being either buried or delayed, diluted and discharged, depending on radiation intensity and half-life period.

Most significant radio-isotope found in the discharge air from air-cooled piles is argon 41. Short half life of this isotope means that mechanical filters and precipitators to take out other possible contaminants are all the treatment necessary before discharging the air through 200–300-ft. stacks. However, air-cooled installations must be elaborately instrumented with meteorological devices which will halt piles' operation when poor aerial diffusion conditions are apparent.

Here are some of the checking devices AEC employs to make sure none of its plants suddenly start exuding billows of deadly radioactive dust: (1) Geiger counters suspended throughout various stages, to check activity of radio-argon, radio-iodine, radio-oxygen, etc. (2) Geiger counters with filters attached to give cumulative readings. (3) Precipitrons from which foils are periodically removed and checked for radiation concentration. (4) Large ion condensers which are charged every 8 hr., the discharge being read with a fiber electrometer. (5) Air way filters drawing at the rate of 60 cfm. (240 fpm. at Oak Ridge) at Brookhaven, whose filter paper is removed after each run and given a 24-hr. photographic film check. (6) Collection frames placed over area around reactor piles. Dust settled here is given periodic film checks.

In the case of water-cooled reactors, the water is first filtered to remove most of the impurities. Those that remain become active while passing around the pile. This "hot" water is then decayed in underground storage tanks and then passed into a large holding pond. From there it is (in the case of Oak Ridge) discharged into White Oak Lake, and subsequently into the Clinch River. This discharge is controlled by three criteria. (1) Maximum average daily discharge, 5 curies, with a week's limit of 35 curies. (2) Radiation level of water can't exceed 100 millireps a day. (3) Dilution factor as it enters Clinch River ranges from 20 to 1,000; final level is many times below maximum safe concentration.

Radiation decay in White Oak Lake is such that only one-fourth the cumulated activity remains after a year. Much of this is concentrated in the mud and algae at the bottom of the pond. AEC figures increased radioactivity around Oak Ridge approximates that incurred by a 5,000 ft. increase in altitude, and that water of Clinch River is considerably less active than that in many American mineral springs.

Other liquid wastes get similar but more thorough treatment. Those bearing uranium are segregated and stored indefinitely. Others are held up, flocculated, and settled in a series of tanks, supernatent liquids then going through same steps as coolant. Final discharge into Tennessee Valley water shows no greater concentration than 1 microcurie per liter.

As an alternative method for processing liquid wastes, much attention is being given to the activated sludge method of treating ordinary domestic and industrial sewerage. These gelatenous colonies of bacteria, their cellular membranes swollen by the water, offer a vast surface for holding radioactive materials. Particularly encouraging is the fact that these bacteria seem to thrive in water of rather high activity.

Experiments indicate that 95 percent of up to 1.4 micrograms of uranium or plutonium per liter can be absorbed by the sludge. Done in two stages, AEC figures a 99 percent removal, producing an effluent with a tolerance or 0.01 microgram per liter.

For the most part solid wastes are simply buried. Where concentration of activity is not too great, they can be burned. However, fumes must be processed, and the ashes buried. A building that has become too active

The seminar was held in Washington, Jan. 24-25, 1949.

must be torn down piece by piece and buried.

"Hottest" solids come from chemical separation processes where highly active fission products must be segregated from unused uranium and plutonium. This equipment must be operated by remote control behind heavy cement barriers. Fumes are scrubbed and filtered (with special asbestos, glass fibers or sand) and discharged through 200-300-ft. stacks. Main activity results from radio-iodine.

Current research and future plans include closed-cycle incinerators, closed-cycle cooling systems, and an evaporation method of treating liquids which promises a decontamination factor of 100,000. Still another procedure involves the use of ion exchange resins.

Chemical precipitation methods are under study too, especially where specific wastes are concerned. Advantage here would be that many non-active salts could be recovered for future use.

## Gaseous Wastes

**Arthur E. Gorman**

**Division of Engineering,**
**Atomic Energy Commission**

■ OPERATIONS which produce waste capable of causing atmospheric contamination include (1) material processing, (2) metallurgy and machining, (3) air-cooled nuclear reactor operation, (4) chemical separations, (5) laboratory research, (6) incineration.

Preliminary preparation of metallic ores of interest in the atomic energy program requires such operations as drying, crushing, grinding, and sieving. Radioactive and toxic dusts are removed from the working space and the atmosphere by ordinary industrial types of mechanical separators, electrostatic precipitators and filters. Better decontaminating equipment is being installed in existing plants working on Commission contracts, and in new plants the Commission insists on installation of equipment capable of removing all contamination.

Similarly in the chemical processing of ores, the fumes, mists and gases are removed by ventilation, scrubbing and filtration before release to the atmosphere. The radiation hazard associated with uranium ores and the refined metal is not excessive in view of the low-level radioactivity.

During the metallurgical and machining operations of such metals as beryllium and uranium contaminating fumes and dusts of the metallic oxides may develop. These are removed by ventilation and filtering in order not to contaminate the work areas or the outside atmosphere. The tentative permissible limit of atmospheric contamination by alpha emitting materials in working areas has been established at $5 \times 10^{-4}$ micrograms or $3 \times 10^{-4}$ microcuries per liter of air.

Air used for cooling a nuclear reactor or pile becomes radioactive, the most significant component being argon 41, having a half-life of 110 min. Carbon 14 is occassionally discharged in very small amounts which are believed to have no public health significance. Under abnormal conditions, uranium oxide and radioactive fission products may also contaminate the cooling air. These materials are removed by proper facilities including filters.

The only air-cooled pile now in actual operation is at Oak Ridge; this pile is equipped with electrostatic precipitators and filters which treat the cooling air before it leaves the stack. A second air-cooled reactor is now under construction at Brookhaven National Laboratory, Long Island. The air will be filtered before and after delivery to the pile and will be dispersed to the atmosphere at high velocity through a stack over 300 ft. high. According to design considerations, atmospheric contamination in the neighborhood of the Brookhaven reactor will be no greater than $10^{-9}$ microcuries per liter. Operation of the pile will be subject to an elaborate system of meteorological forecasts and the level of operations will be governed accordingly.

Fission products of uranium exposed to neutron bombardment in a reactor are highly radioactive. These fission products are separated from unused uranium and plutonium by a variety of chemical processes. The equipment is largely automatic and operated by remote control. Provision is made to remove radioactive particles which might contaminate the atmosphere by scrubbing and filtering the dissolver off gases. Filters currently in use are made of special asbestos, glass fibers or sand.

Dissolving operations are not carried out when meteorological conditions are unfavorable, and elaborate facilities are maintained at the production areas in order to supply the necessary meteorological information. At operating areas ventilating exhaust air and dissolver off gases are discharged through high stacks 200 to 300 ft. high.

Prior to the installation of exhaust air decontamination equipment, it was believed that a combination of high stacks and large volumes of diluting air would result in adequate diffusion of contamination. Air, ground and vegetation tests made in the vicinity of the stacks and at off-site locations many miles away indicated a possible need for decontaminating exhaust air prior to discharge to the stacks. This is now being done as described above.

Radioactive iodine, having a half-life of 8.3 days, was the principal contaminant. It was found in low amounts in vegetation many miles away. The permissible limit set for radioiodine contamination of vegetation is 0.2 microcuries per kilogram. For atmospheric contamination with radioiodine $3.5 \times 10^{-8}$ microcuries per liter of air is the permissible limit. A small percentage of particles was found to have half-lives measured in months, while a very small amount consisted of long-lived particles having half-lives of a year or longer.

Careful consideration of this situation by the Commission's Advisory Committee on Biology and Medicine led to the conclusion that no undue public hazard had been created prior to the installation of decontaminating equipment. Since the installation of this equipment, the problem has been reduced although constant monitoring of air and vegetation in the vicinity of the stacks and for considerable distances around is carried on.

Gaseous effluents from research laboratories have varying levels of radioactivity. In new laboratories, high-level working areas are usually kept separate from low-level and so-called clean areas. The areas are served by separate ventilating facilities usually arranged so that even in emergency high-level activity can never contaminate an area of lower level. Inlet and exhaust air is filtered and monitored regularly. As a further precaution, in some laboratories having high-level activity, actual work is done in special sealed boxes set in ventilated hoods, manipulation of radioactive materials and equipment is carried on with protective gloves or by remote control.

At some of the older laboratories, especially where existing facilities were adapted for research on radioactive materials, facilities have not always been adequate to provide complete radioactive decontamination. These laboratories are being remodelled or replaced.

Burning of radioactive wastes and byproducts cannot be followed unless provision is made to decontaminate the products of combustion. This requirement is not a simple one to meet, but studies for improving incineration methods are in progress.

Late in May 1948, the general

■ Abstracted from the paper presented by A. E. Gorman at the AEC seminar.

manager appointed a group of industrial consultants to advise the Commission on stack gas problems. This committee of seven experts has recommended that special research be done on various immediate and fundamental problems in treating gaseous effluents peculiar to atomic energy operations. These projects include the development of more effective filters and filter materials, better methods of removal of iodine from dissolver of gases, processes for bottling up of rare gases, development of an improved incinerator, studies of new types of mechanical and electrical decontaminating facilities, methods for more precise determination of particle sizes, standardization of sampling techniques, and the improvement of measuring instruments. In addition to efficiency, problems of cost are an important consideration in such research.

## Liquid Wastes

**W. A. Rodger,**

**Chemical Engineering Division**
**Argonne National Laboratory**
**Chicago, Ill.**

■ WHILE there is no evidence that present practices of liquid waste treatment at most of the major atomic energy plant sites constitute an immediate hazard, some of them are potentially hazardous and it is doubtful if some others should be continued indefinitely or should be scaled up by a very large factor.

Our biggest immediate problem is a psychological one. An improperly informed public can easily become unduly alarmed by "scare stories" that sometimes break into the press. Within the limits of security, it is necessary to let people know what the problems are and how they are being solved. On the other hand, from the long-range viewpoint, the disposal systems now being used are not the most desirable. Work should be and is being carried out to develop adequate systems for all sites.

Liquid wastes are produced in some quantity whenever radioactive materials are processed; e.g., the bench drains and wash-up sinks of a radiochemical laboratory. Since it is the practice to collect all known active wastes in special containers, activity which gets into the laboratory drainage system is at a very low level, in the order of a few millicuries per month. The composition of such waste may vary from time to time; it will be mixed with a relatively large volume of water; and it will generally be low in salt content. Any treatment system must be flexible.

In pilot plant operations and in production plants the waste disposal problems encountered in the laboratory are scaled up so that much larger amounts of active wastes are produced. Amount and type will vary with the operation. For any particular process, however, a waste of known composition will be produced routinely. Concentration of radioactivity may be very high and the amounts of inactive salts may run up to 40 or 50 percent. Such wastes are more difficult to handle as heavily shielded equipment may be needed, but because the feed composition is known, specific treatment processes can be devised and equipment selected to carry out the necessary operations.

Work done at hospitals, universities, industrial laboratories and other non-AEC facilities usually involves the use of only very small quantities of radioactive tracers.

At Argonne National Laboratory, Brookhaven National Laboratory and Knolls Atomic Power Laboratory, somewhat larger quantities of radioactive wastes may be expected. All of these sites are presently building facilities which may be used as interim processing units and which will allow research and development to be carried out to determine ultimate systems. In the meantime, wastes are collected in suitable containers and shipped to sites with disposal facilities.

At the Oak Ridge National Laboratory, a pilot plant is operated in addition to a research unit. Here activities in the order of kilocuries per month are processed and the total volume of waste may reach 50,000 gal. per week. The waste disposal system consists of a series of holdup tank and a retention pond of over 1,000,000 gal. capacity. Uranium-bearing wastes are segregated and stored indefinitely. Other wastes are held up, flocculated, and settled in a series of tanks. The supernatant is discharged to the retention tank where it is diluted with large volumes of water and discharged to the Tennessee Valley water system at concentrations no greater than 1 microcurie per liter.

The plutonium production plant at Richland, Wash., produces the largest volume of waste and the greatest quantity of radioactivity found at any site. The waste disposal system at Hanford resembles the one at Oak Ridge, but it is much more extensive. Uranium-bearing wastes and the most active nonmetal wastes are stored indefinitely. Less active wastes are held up and are disposed of by other means.

There is a thick layer of volcanic ash in this area which absorbs activity very completely and so far has been successful in holding the activity close to the discharge point. This is an example of discharge to nature in such a way that the activity is confined.

Much work is started on developing methods which will allow the return to nature of the water, while retaining essentially all the activity. One method which seems certain of success but which may be laborious and expensive is evaporation. Work so far has shown that a decontamination factor of at least 100,000 is possible. For many wastes, this is adequate. For others, a retreatment of the distillate might be required.

The use of ion exchange resins is also under study. Many possible processes will be tried. For instance the distillate from a single evaporation might be put through a resin column to assure removal of the last trace of activity. Rather than re-use the resin, it may be desirable to dry and incinerate it ending up with only a small volume of active ash to be stored.

Various chemical precipitation methods will be investigated. These will probably work best on specific waste streams from routine processing.

Certain of the present waste streams contain high concentrations of nonactive salts which may be recoverable for re-use. This is desirable from two standpoints. It would represent an economic saving and would make unnecessary the storage of the bulk solid. One such scheme now under consideration involves precipitation of the salt with 100 percent $HNO_3$, separation of the solid, and recovery of the acid by distillation. Most of this work is in the very preliminary stage, but early indication is that much of it will be successful.

The stated aim of the Atomic Energy Commission is to discharge no activity to nature. Practically this is a very difficult thing to do. Tolerances will be set probably at or near the natural backgrounds for the areas involved.

The biggest lack at the moment is sufficiently laboratory and semi-works development on the suggested processes. Much is planned but at the moment most sites are held up for facilities in which to do the work.

From preliminary investigations, I am convinced that the goals can be met and further that no new and complicated equipment will have to be designed. It should be possible to solve all of these problems using conventional unit operations and commercially available equipment.

Digest of Dr. Rodger's talk at the AEC seminar.

# Federal Waste Law

**Sets up waste control organization. But funds are few and enforcement is vulnerable to delaying tactics.**

**PUBLIC LAW 845**
An Editorial Staff Summary

■ LAST year the 80th congress passed the Water Pollution Control Act. Covering all interstate rivers and their tributaries, it authorizes the federal government to study, advise and help finance pollution control programs. And with the consent of the state concerned, it can eventually force industry to take whatever steps the courts decide. Court action against an industrial offender, however, is subject to time-consuming legal procedures.

While the bill authorizes the federal government to help defray the cost of municipal pollution control projects, it makes no such provision in the case of industry. However, $1-million a year is authorized for grants to states for conducting research, surveys and studies of the prevention and control of water pollution from industrial wastes. The money is provided for in the fiscal 1950 budget.

So far, little progress has been made towards putting the new law into effect. One reason is that, to date, no money has been appropriated. However, President Truman's budget for the coming year sets aside a total of $2.9-million to start government in the business of stream pollution control.

Public Law 845, as the act is called, makes the surgeon general of the Public Health Service (of the Federal Security Agency) over-all coordinator of the government program. At the same time it puts the Federal Works Agency in charge of federally-financed construction. Both FWA and PHS must approve any government-financed construction projects.

Directly under the surgeon general is the office of Environmental Health Service, two divisions of which are the Division of Water Pollution Control and the Environmental Health Center, research station at Cincinnati, Ohio. The research facilities at Cincinnati will handle the biological phases of pollution control. This will raise the number of men working on stream pollution from 4 to nearly 12.

Under the Division of Water Pollution Control are to be 14 river basin offices covering the major U. S. drainage basins. Their job will be to conduct over-all studies, determine extent and sources of pollution, advise on corrective measures and coordinate state and industrial programs.

Two river basin offices are already set up and operating: No. 14 at Portland, Ore., covering the Pacific Northwest and Columbia River Basin; and No. 8 at Kansas City, Mo., covering the Missouri River Basin. By July 1, 1949, a total of eleven river basin offices will be in operation, covering every section of the country except California, Arizona, Nevada and sections of Colorado, Utah, New Mexico and Wyoming. The eleven will be located at New York, Boston, Washington, Dallas, Little Rock, St. Louis, Atlanta, Cincinnati, Portland, Kansas City and Chicago. Three which still remain to be set up will be located, one at Boulder City, Ariz., and two at San Francisco. Each office will be run by a staff of only four or five, consisting mostly of sanitary engineers, biologists and chemists.

These field offices are getting down to work—plan to cover the country, basin by basin. The present idea is to concentrate the staffs of several of the offices on a single project until the study is completed and then move on to the next. For example, PHS is considering bringing in sanitary engineers, biochemists and other technicians from several offices around the country to polish off the already-started survey of the Ohio River valley. Once a study has been completed, PHS will go to the state and suggest what remedial steps be taken. Since most state pollution officials favor the present law, PHS expects cooperation.

In cases where local governments are at fault, things like municipal sewerage, FWA is empowered to make grants to pay for part of the engineering expenses, such as studies and plans for treatment facilities. To cover cost of these grants, the act authorizes $1-million a year for five years beginning July 1, 1948, and ending July 1, 1953. FWA didn't get any of this money in 1948, and the budget only allots $500,000 for this purpose in fiscal 1950. After planning is completed and approved by PHS, FWA, and the state, FWA is empowered to go ahead and help pay for the construction of sewerage treatment works or whatever the situation calls for. Congress again authorized money for this—$22.5-million a year for the five-year period mentioned above. And again, no money was appropriated in 1948; none included in next year's budget.

Where an industrial waste is the culprit, PHS will notify the industrial plant and suggest what steps should be taken within a specified time limit, at the same time notifying the state pollution agency concerned. If action is taken within the time limit, good. But if it isn't, PHS must start through a long series of procedures which could run as long as seven years before final enforcement is possible. Next step is to notify both company and state again, this time suggesting that the state initiate a court suit to force compliance. If this fails, and the state initiates no suit, the Federal Security Administrator is authorized to call a public hearing. Recommendations of the hearing are turned over to interested parties and another time limit set for action. If still no steps are taken to control pollution, the Federal Security Administrator, with the consent of the state, may bring suit on behalf of the U.S. to secure abatement of the pollution. The court is given power to enforce its judgment.

With the numerous legal devices available, final enforcement could be delayed for years. The above procedure applies to individuals, corporations, partnerships, associations, municipalities and political subdivisions of states. However, no direct action can be taken in any case without the consent of the states concerned.

Public Health Service can proceed against industrial offenders without having to wait for money to be appropriated as in the case of municipal pollution. However, in most cases the idea will be to get municipal programs under way before starting on industry.

PHS is banking on public opinion rather than court action to put its program over. It cites the fact that already it has the support of Kiwanis clubs and sportsmen, including the over 14-million licensed fishermen in the country.

# AEC Reports on Its Progress

**Fifth semi-annual report shows chemical engineering advances in production have cut operating costs**

HAILED as one of the most important governmental documents on atomic energy since the famous Smyth report, the fifth semi-annual report of the Atomic Energy Commission contains much of interest to chemical engineers. Production problems and facilities, research in the physical sciences and in biology and medicine, patents and inventions comprise 90 percent of the 200 pages. Yet the only section that made newspaper headlines was an 8-page chapter on military applications in which there were some broad hints on the development of super atomic bombs.

Here are a few highlights of more immediate interest to chemical engineers:

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*Raw Materials*—More than 30 contractors are today engaged in producing feed materials for the atomic energy plants and in research aimed at improvement in plants and methods of production. Among them are such organizations as Battelle Memorial Institute, Electrometallurgical Co., Harshaw Chemical Co., Linde Air Products Co., Mallinckrodt Chemical Works, Massachusetts Institute of Technology and Vitro Mfg. Co. An entirely new plant for extracting and purifying uranium oxide was built and put into operation in 1948. Taking 100 as the 1946 level of cost per unit, for 1947 it was 83, and for 1948, 79. Comparable improvements were also reflected in bringing down the cost of the "green salt" (uranium tetrafluoride) made from $UO_3$. Cost for producing uranium hexafluoride for Oak Ridge dropped from 100 in 1946 to 97 in 1947 and to 87 for 1948.

To prepare extremely pure uranium metal for Hanford, construction of a new metal plant was started in 1948. It will incorporate all the technological improvements resulting from five years of operating experience. It will greatly enlarge production capacity and will provide for safer, cheaper and more efficient operation. The total capital investment for this plant is estimated at $2,500,000, of which $350,000 had been expended by the end of 1948.

A 27,000 sq.ft. building has been purchased at New Brunswick, N. J. and is now being rebuilt for use as an analytical laboratory to control quality of uranium and other special materials.

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*Production Facilities*—The gaseous diffusion plant at Oak Ridge, now the largest continuous process plant in the world under a single roof—a 60-acre roof—has been the scene of many interesting improvements. Barrier manufacture which since its inception has been a batch-type operation may soon be made by a more efficient and continuous process of production.

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The corrosion-resistant plastic, fluorothene, which was developed during the war, is now being manufactured by private industry and is finding many special chemical engineering applications.

During 1948 two major design studies were completed at Oak Ridge —one for an addition to the gaseous diffusion plant, the other for an entirely new plant of greatly increased efficiency. The addition to K-25 results from design studies completed by Carbide & Carbon Chemicals Corp. Contract was awarded in December to Giffels & Valet, Inc., for construction to start in the summer of 1949 and to be in operation by late 1951.

The proposed new gaseous diffusion plant would be much smaller than K-25. It is expected that the new plant will produce U-235 much more economically than does K-25. The Commission is now undertaking economic, material and other surveys to determine the feasibility of this project.

At Hanford the big problem has been to rehabilitate existing equipment while plants are being built to replace present facilities and research being pushed on the development of new and more efficient processes and operating techniques. Late in 1948, however, the production rate of the original reactors was greater than any achieved in wartime. New chemical processes that should bring big savings in uranium are now in the pilot-plant stage.

To speed up this program the Commission has assembled a large aggregation of scientific and engineering talent. In addition to its own laboratories, the General Electric Co., as principal contractor, has had the consulting services of Standard Oil Development Co., Carbide & Carbon Chemicals Corp., Kellex Corp., Blaw-Knox Co., Monsanto Chemical Co., and Dow Chemical Co. Late in December Du Pont agreed to survey the total problem of research and engineering involved in the chemical processes used in the production of plutonium.

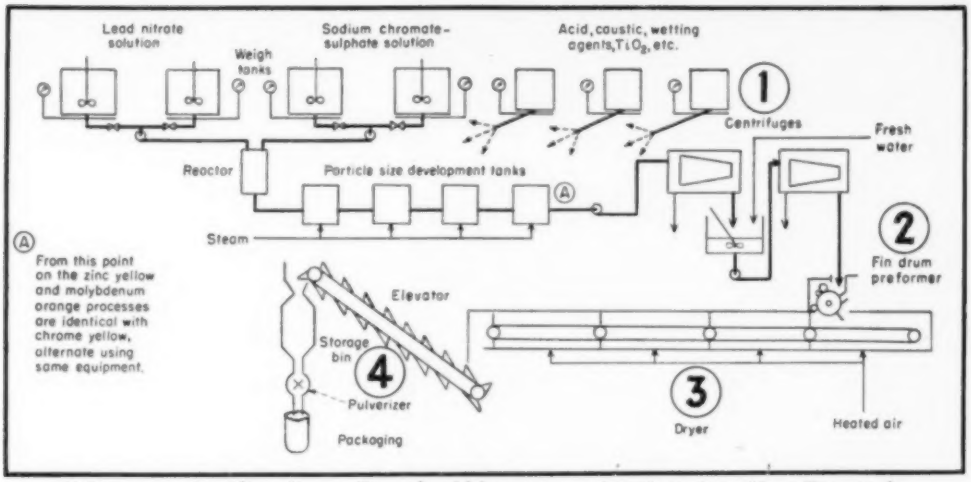
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*Instrumentation*—During the past two years a great new industry has been developed to supply radiation detection instruments such as are essential everywhere in the atomic energy project and also required in large numbers by its contractors and research agencies. Up to 1945 only six commercial firms had manufactured complete instruments for sale. By the beginning of 1947, their output had grown in value from a third of a million to more than a million dollars. It has doubled each year since so that today it stands at some $4,000,000 a year. There are 24 companies that manufacture complete instruments and others that produce various components.

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*Special Reports and Technical Data*—Both the technical and managerial phases of the development of nuclear reactors for the generation of power and for nuclear research will be covered in a forthcoming special report to Congress being prepared under the direction of USAEC General Manager Carroll L. Wilson.

Late in 1948 the Commission issued a general list of unclassified areas of research relating to atomic energy. These include basic chemistry, physics and mathematics except for weapons, medical and biological research and health studies, instruments including counters and accelerators and the chemistry and technology of fluorine compounds. It is evident that more material will become available of interest to engineers during the next few months. This is in line with the recommendations made late last year by the Industrial Advisory Committee headed by Dr. James W. Parker, president and general manager, Detroit Edison Co.




DuPont's new unit produces chrome yellow and molybdate orange continuously as above. Zinc yellow uses the same equipment from the centrifuge on; however, it requires batch tanks for reaction and particle size development.

# Continuous Chrome Yellow Process

New technique saves time and money over conventional batch methods. Neatest tricks are continuous reaction and continuous particle size development.

**Roger Williams, Jr.**

Assistant Editor, *Chemical Engineering*

Did you ever try to conduct an inorganic reaction continuously, precipitate a solid at a given particle size, separate and wash those solids, and then dry them, all continuously? Well, that is just what the Pigments Department of the Du Pont company is doing in its new unit at Newark, N. J. This new section of the plant, which produces several thousand pounds an hour, turns out three different classes of related products. They are the yellow pigments known as chrome yellow, zinc yellow and molybdate orange. The processes for making chrome yellow and molybdate orange are completely continuous from start to finish. In the case of zinc yellow the reaction is conducted batchwise, but the washing and drying are continuous. The plant can shift from one to another of these products as sales patterns demand.

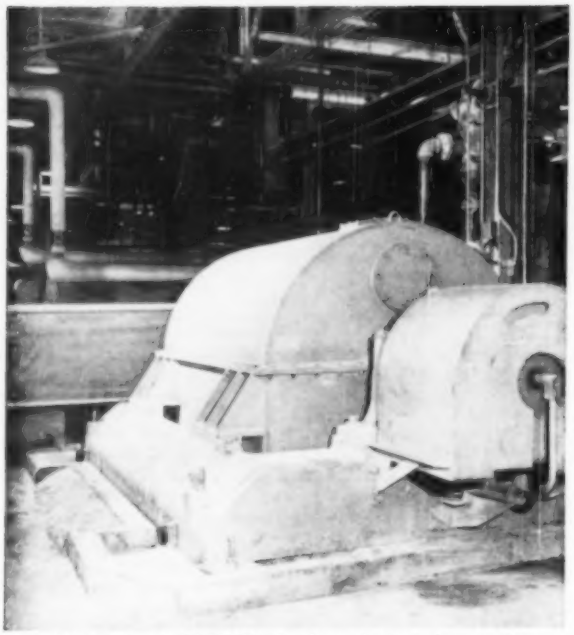
Perhaps the neatest trick in the plant is the continuous reaction to form chrome yellow. The previous process had involved a batch reaction in large agitated tanks, and the total time to run a batch through the bagged product was several days. In the new plant the total time involved from raw material to bagged product is only some two hours. When the problems presented by particle size, configuration, and distribution are considered, one can visualize the magnitude of this achievement.

Not only have these problems been worked out in developing the process, but the result is better yellow pigments. The accurate and automatic controls which can be used now make possible more uniform and higher quality yellows than were obtainable by the old batch process. Factors in production are controlled with an accuracy not practical heretofore. The result points out the ability to apply modern chemical engineering techniques and equipment to an old process with real economic results. The job was not easy; it took more than five years of research work. But the result was worth the effort.

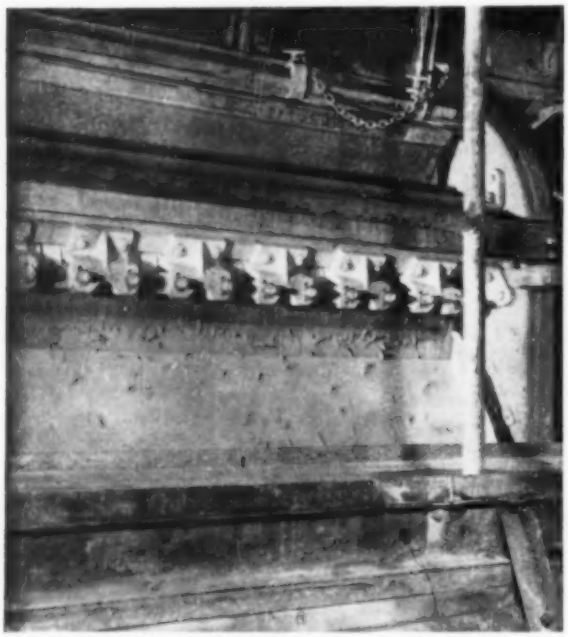
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Production of chrome yellow begins with the reaction of lead nitrate with sodium chromate. Lead nitrate is produced at the same plant and is pumped to the yellow pigments unit in solution. The second major ingredient, sodium chromate, is purchased as a 35 percent solution in tank cars. Another secondary reactant is sodium sulphate, which is sometimes used up to 35 mol percent of the quantity of sodium chromate. Varying proportions of the latter ingredient produce the different grades of chrome yellow sold.

The lead nitrate and sodium chromate solutions are controlled by means of automatically integrated rotameters and valves. These solutions react in a specially designed



**1** CONTINUOUS CENTRIFUGE, where the lead chromate from developers, is separated from the other reactants and washed.



**2** CONTINUOUS DRYER FEED, where paste from last centrifuge is compacted so it will not blow away in air stream in the dryer.

reaction chamber, which is unusually small compared with the customary cumbersome tanks used in batch manufacture. This reaction is a very rapid one so that a total holdup in the reactor is only a matter of a few seconds.

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FROM the reactor, the slurry of precipitated lead chromate particles feeds to another series of reaction chambers. These vessels supply the holdup at elevated temperatures and for different times that give the required particle size adjustment. When one considers that the average particle size involved is less than 1 micron in diameter, and can be seen only in an electron microscope, it is rather amazing that the heterogeneous group of particles that have been precipitated initially can be continuously converted to a uniform particle size. The job is done by various holdup times at differing pH's and temperatures. Temperatures are controlled automatically; pH's are controlled and recorded at the central control panel which is the operating heart of the unit.

There are other additives introduced into the lead yellow pigment during these steps. These additives include titanium and aluminum salts to give better working properties, and organic surface active agents. All of these materials, including acids and alkalis for pH adjustment, are added by means of automatically controlled equipment.

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**1** FROM these steps the slurry is pumped to the first of a series of centrifuges. These are 60-in. diameter, solid bowl, continuous Birds, built of stainless steel for corrosion resistance. They discharge a heavy paste which has about 60 percent solids content. From all but the last centrifuge, the paste drops by gravity directly into agitated wash tanks. Here the particles of lead chromate are reslurried with fresh water to wash away any soluble salts. From the last centrifuge the paste goes directly to the dryer. The efficiency of these centrifuges is rather remarkable and can be illustrated by pointing out that the overall yield of the process is over 99 percent.

•

**2** THE PASTE from the last centrifuge drops by gravity to the feed hopper of the dryer. The dryer feeder is of the fin drum type, manufactured by Proctor & Schwartz. This consists of a hopper above a steam-heated, notched cylinder. The notches, which run around the circumference of the cylinder, are about ¼ in. across and ¼ in. deep. Part way around the circumference of the cylinder is another smooth surface cylinder. With the two cylinders rotating in opposite directions, the paste is forced into the notches of the large cylinder, forming a sort of rod. Since the notched cylinder is steam-heated, some drying takes place on its surface. Three-quarters of the way around the cylinder notched doctor blades breaks off the now-solid rods of lead chromate. A feed of this sort to the dryer is necessary in order to get a firm lump which will not blow away

in the air stream. The size of the lead chromate particles is so small that some such compacting device is necessary.

•

**3** The rods from the feeder drop directly onto a continuous, stainless steel belt Proctor & Schwartz dryer. The dryer is some 70 ft. long and is divided into separate sections. Because of these sections, the air temperatures can be varied to give the best possible drying conditions in each section. The unit is heated by high pressure steam and drying temperatures are about 225 to 250 deg. F.

From the belt dryer the solid rods drop into a screw conveyor which moves them out of the dryer at right angles to the dryer belt and feeds them into a bucket elevator. The bucket elevator conveys the solid up to an overhead bulk storage. This storage bin, stainless lined, is equipped with a level indicator and vibrators.

•

**4** From the bottom of this bulk storage, the solid rods are again picked up with a bucket elevator which feeds a small holdup storage. From this bin the solid drops through a "Mikro-Pulverizer" which breaks up the rodded solids into a fine powder. From the pulverizer the solids drop through a small holdup vessel into the bagging equipment. The product is bagged in 50-lb., multiwall paper bags.

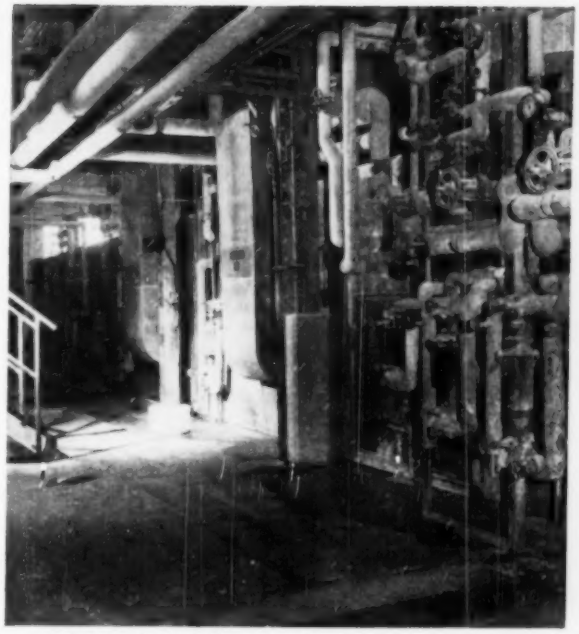
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Production of zinc yellow is similar to that of lead yellow outlined above, with the exception that the reaction and particle size development steps are carried out batchwise. Zinc yellow is a basic potassium zinc chromate corresponding to the formula $K_2O.4ZnO.4CrO_3.3H_2O$. The reaction is carried out in large, agitated tanks. Several tanks are used so that while one is completing the reaction the other can be feeding the separation and drying end of the process.

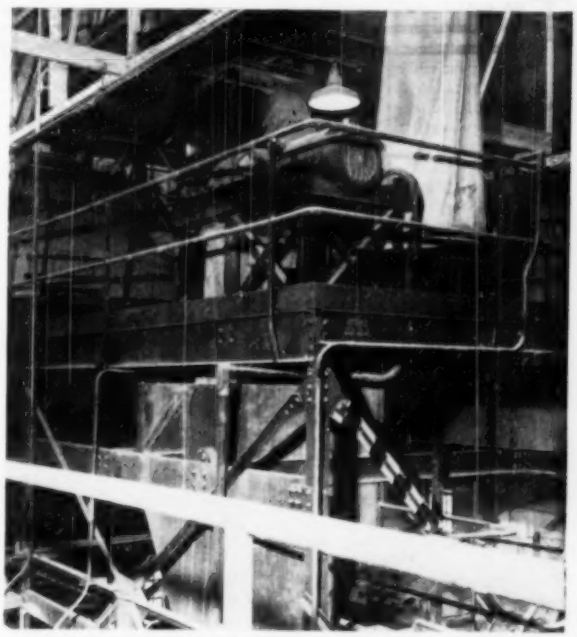
The slurry is pumped from these tanks to the first of the centrifuges. From this point on the process is identical with that outlined above for lead yellow, and uses the same equipment. Obviously, all the equipment from the centrifuges on must be cleaned whenever there is a change in the pigment produced by the unit. The equipment has all been designed with a view toward easy and complete cleaning.

Such is the method, in broad outline, that DuPont uses to produce yellow pigments continuously. The net result has been more uniform production and improved pigments with greater production at improved operating efficiency. The new process turns out yellow pigments having higher tinting strength, better light fastness and working properties as well as better stability and uniformity of particle size that was obtainable with the old system of production.

In conclusion, the author wishes to acknowledge the assistance and cooperation of G. R. Cantwell, plant manager, and his associates in securing the information on which this article is based.



**3** CONTINUOUS DRYER, where the pigment, moving on sections of a 70 ft. stainless steel belt, is dried by air at 225-250 deg. F.



**4** CONTINUOUS PULVERIZER, where dried pigment is broken up into a fine powder. It is then packaged in 50-lb., multiwall bags.

# Commercial Chemical Development

Lack of past experience need be no handicap to sound chemical development. These basic concepts are the guideposts to follow.

**Hoyt M. Corley**
*Armour & Co.*
*Chicago, Ill.*

THE FIELD of commercial chemical development is not as fortunate as that of insurance companies who have the cold illumination of past experience, plus a careful examination of each individual risk to guide them in each of their commitments. When a new chemical is first synthesized, there is no past experience and no factual data on which to base decisions. As a substitute for the insurance actuaries' experience, commercial chemical development has a series of guideposts in the chemical field, and when these guides are properly followed, every new chemical development can be kept in sound economic channels.

If a commercial chemical development is economically sound, it usually requires a number of years of effort. It must include every phase of the various activities necessary to transfer a chemical from the testtube stage to full-scale production and to expanding its fields of utility to the largest possible number of outlets.

The activities of such a development include the following stages: Pilot plant process development, applied or use research, technical service, chemical market development, semi-works, market research, survey and appraisal. Regardless of variations of the names by which these steps are known in different corporations, each is essential to sound economic development of a new chemical having no established fields of utility.

The chemicals with which commercial chemical development is concerned may be divided into three broad categories: (1) Known chemicals for old, well-established fields of utility; (2) Either new chemicals, or new processes for manufacturing known chemicals, which are intended for old, well-established fields of utility; (3) New chemicals, not previously available, having no proved fields of utility and which require the development of processes for economical manufacture. Chemicals in the first two categories will require much less time and fewer of the steps than those in the third.

Complete information on those in the first category will be available; a market survey and a determination of costs will permit an accurate determination of possible profits. For those in the second category, considerable work will be required from the chemical pilot plant, process development department, semiworks, technical service, market research, and survey and appraisal to provide management with data of the same accuracy as that which is readily obtainable for chemicals in the first category.

Chemicals in the third category are the main concern here. In the case of these chemicals, each of the steps of commercial chemical development is required to its full extent. Some idea of the magnitude of the number of chemicals in the third category can be gained from the following figures: The 1939 edition of Beilstein states that more than 300,000 organic chemicals are known to be in existence. The United States Tariff Commission obtains confidential information on the production and sales of all organic chemicals which are known to be in production in this country. Starting with their list of 7,000 items, and using 20,000 lb. annual production as a gage, it is estimated that the total list of commercially important chemicals would be considerably less than 3,000 items. The rest may be considered open for development.

### Chemical Qualifications

However, for a successful commercial development, a chemical must be found that has, among other attributes, the following qualifications: Unique physical and chemical properties that lend themselves to application in a wide variety of fields; expected large-scale, commercial production cost at a reasonable level, perhaps less than 50c. per lb.; and raw materials freely

## Chemical Development—The Basic Concepts

1. Uses for a new chemical must be thoroughly worked out and proved before an attempt is made at plant application.



2. Data should be obtained and released through the usual technical journals and through talks to technical groups, as soon as possible.

3. Before a new chemical is announced, enough samples should be on hand to supply an ever increasing number of research workers.

4. Samples should be distributed to potential customers for evaluation of future fields of utility.

5. Technically trained personnel should visit laboratories where evaluations are in progress, to give guidance in proper handling of the new product.



6. Now an advertising campaign should be undertaken in the top-flight technical magazines—and later, once there are proved applications, in the trade journals.



7. Hand out samples to anyone interested. Only about 25 percent of the applications will be discovered without outside help.

8. Use trade names sparingly. No chemist can work intelligently without exact data, physical and chemical, on the new product.

9. All correspondence with potential customers must be handled by trained personnel, otherwise these customers are apt to lose enthusiasm.



10. Keep all information booklets simple. Send most of your information to researchers by letter, thus keeping it personal and up-to-date.

11. Treat all outside developments as confidential until the other party agrees to publication.

12. When it is time for salesmen to make their calls, send only sound, technically trained men. Give the customer regular, satisfactory deliveries and needed technological assistance.

available in large enough quantities that the volume of production can reach any magnitude dictated by demand.

When a management decision has been reached to proceed with the exploitation of a new chemical meeting these requirements, and the research group is ready to supply small samples and data, the development of uses for a new chemical is fairly simple if everyone connected with the development keeps a few basic concepts foremost in his thinking and planning.

First of these is that uses for a new chemical originate and are developed in the various research laboratories and that any new idea must be thoroughly worked out, tried, and proved before an attempt at plant application is made. This usually requires considerable time and increasing amounts of the new chemical as the various developmental stages are reached. No use should be considered as proved until after a potential customer has made several trial plant runs and confirmed the expected results.

High-pressure salesmanship has no place here, it can obtain only inconsequential orders for trial quantities of new, unproved chemicals. If a chemical performs some function in a superior manner a potential customer will, in time, be forced to use it to meet competition and stay in business.

Second, all possible physical and chemical data should be obtained and published in the usual technical periodicals as soon as possible. Every successful commercial adaptation or development will depend on the proper interpretation and application of this information; the answers to important commercial problems may hinge on some obscure physical or chemical characteristic which would have been missed without a systematic study of the material.

The people responsible for developing the new chemical and those responsible for determining the chemical and physical data should give talks to technical groups whenever possible in order to stimulate the search for applications.

Third, before the announcement of any new chemical, provision should be made for the production of laboratory samples, and, for at least, sizable pilot plant samples or pilot plant sales. If the chain of increasingly large samples required by a research laboratory is broken at any point, it is very difficult to go back and have the work begun again at the point where it was left off. In almost every case where this chain is broken other methods will probably be found for accomplishing the same or similar end results and it will be almost impossible to revive the evaluation.

Despite the stress which has been placed in recent years on market research, it has no value at this stage of development. In the semi-works stage it is vitally important, but in this early phase a new chemical is not yet in competition with any known product and market research will be able to determine nothing of value.

Fourth, a study of the chemical and physical properties of the new item should be conducted and a list made of all the potential fields of utility. Then submission of samples should be started, and continued until at least six potential customers in each of the fields have carried out evaluations. The differences among their responses, due to varying techniques and methods of handling, are likely to be surprising.

Fifth, technically trained personnel, liberally supplied with common-sense and thoroughly familiar with the new product, should visit the various laboratories and plants while the evaluations are in progress. Most chemicals can be supplied in a series having slightly different physical and chemical characteristics. It is very likely that technically trained personnel will be able to suggest another chemical in the same series, which can be readily produced by the same process,

and will more nearly fit the potential customer's requirements.

One of the greatest benefits of having technically trained personnel of this type present at an evaluation is that they can see that the new chemical is not unintentionally mishandled because of lack of experience with it. The presence of such technicians insures the new chemical every opportunity of performing satisfactorily.

### Advertising

Sixth, a carefully planned advertising program on this new chemical should be instituted, but only in the top-flight technical periodicals. At this stage, trade magazine advertising and other common promotional schemes have little if any value. The point to keep uppermost in planning this campaign is that this advertising must excite interest in the chemical and obtain genuinely interested experimenters in fields of application unknown to the manufacturer. When there are proved applications, these should also be advertised, but not in the more highly technical publications. The promotion of such uses should be confined exclusively to trade journals, where the audience that will be of the most benefit to the advertiser can be reached.

Seventh, samples should be submitted promptly to everyone who appears genuinely interested in making an evaluation. Since no matter how large a chemical manufacturer's research staff may be, only about 25 percent or less of a new chemical's uses will be discovered without outside help, it is worse than useless to restrict samples very much. Besides, anyone with even fairly good connections in the chemical trade can obtain a sample indirectly if he wants to. Since this is the case, it is generally wise to release a new chemical item as soon as pilot plant or semi-works quantities can be made available.

The follow-up on sample submissions, both by correspondence and personal call, is vitally important. It is generally better to submit samples in the usual way and supply all chemical and physical data by correspondence rather than by personal call. After a few days' work with a new chemical, the sample recipient will have dozens of questions to ask which are not covered in the promotional literature and would not have been discussed during an earlier visit.

Eighth, trade names should be used only for shipping and billing purposes. Full chemical names and detailed physical and chemical data should always be supplied on both samples and sales. No chemist can work intelligently with a new chemical unless he has exact data showing its composition, purity and formula. Most chemists today refuse even to try any new chemical on which these data are not supplied. Prior to 1925, chemicals could be successfully merchandised under trade name and most of the people working with them could be made to believe that the composition was secret and could not be readily determined. Any chemist worth his salt today knows that with proper equipment he can take a pound of any material into the laboratory and within a period of approximately two weeks determine its exact composition. Supplying the chemist with exact information on the material with which he is working takes him into your confidence and engenders a feeling of greater personal interest in the results obtained. Irrespective of emphasis placed on trade names, all of those with authority in any organization will always know and think in terms of the correct chemical name.

### Customer Correspondence

Ninth, only competent, technically trained personnel should handle correspondence with potential customers. Recognition of the fact that not more than 25 percent of a new chemical's possibilities will be discovered without outside help makes it imperative that all correspondence be carried on at a level achievable only by competent, technically trained people. Most chemicals which have failed to develop into commercially important items, assuming that they had merit and reached the sample submission stage, did so because of lack of submission of samples and data to a representative group of outside laboratories, failure to keep interested experimenters supplied with adequate quantities of the new chemical, or failure of the persons charged with handling these contacts to create the necessary spark of enthusiasm in the sample recipients.

Tenth, booklets or brochures should not be sufficiently elaborate to eliminate the necessity of supplying additional information by personal letter. Every chemist likes to feel that he is working with a new chemical, and if the information which he receives on a new product does not bear the earmarks of being old and generally disseminated, much more time and effort will be given to adapt this product to a particular problem.

Eleventh, and vitally important, all phases of outside contacts in the development of new chemicals must be on a strictly confidential basis until the other party agrees to the publication of the details of his process. Cases will develop where publication is mutually desirable, but in the majority, publication and even idle outside discussion of details must be rigorously avoided.

The weakest form of promotion or advertising is publicizing a competitor's specific use of a new chemical and urging the adoption of it solely because it is used by the competitor. Any successful organization is interested in leading competition, not following it.

Twelfth, only sound, technically trained personnel should be employed for calling on old, established, as well as prospective customers. Chemical selling today is based on service to the customer, about equally divided between technological assistance, when needed, and regular, satisfactory deliveries.

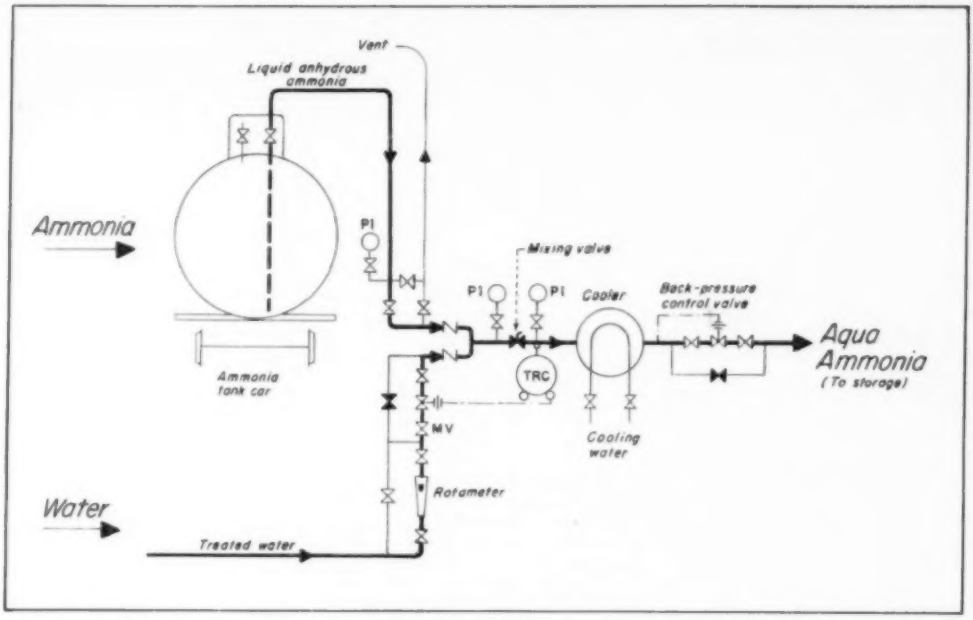
In a great many organizations the biggest hurdle that a new product has to negotiate successfully is the transfer from the technical service department where it has been during the early stages, to the regular sales department where it will be during full-scale commercial production. Many worthwhile new chemicals have failed to reach commercial importance because of lack of knowledge and interest when they were transferred to the regular sales department.

### Development Progressions

The phases of commercial chemical development are a series of progressions which must be taken in regular order if the project is to be kept in sound economic channels. This order is: (1) pilot plant process development; (2) applied or use research; (3) technical service; (4) semi-works; (5) chemical market development; (6) market research, survey and appraisal; (7) full-scale commercial production.

The order of these succeeding steps is of extreme importance for soundness. None of them should be skipped. The next succeeding step should be undertaken only when the consumer demand for the new chemical is already greater, or developments conclusively prove that it soon will be, than the volume obtainable from the preceding stage. Following this system there is never any question as to when to take the next step; each phase provides its own answer and the next step is not taken until the previous one has been outgrown.

A multitude of seemingly unimportant details constitute the mortar for cementing the various segments of a chemical development into an integrated whole. The reward for intelligent handling is success, the price exacted for glossing them over may well be failure.




# Ammonia: Anhydrous to Aqua

Here is an easy way to add water to anhydrous ammonia. System is simple, automatic, and saves cost of shipping water.

**J. Tielrooy**

*Chemical Engineer, Shell Chemical Corp., Pittsburg, Calif.*

A SIMPLE process has been developed for the preparation of aqua ammonia by direct line mixing of water and anhydrous ammonia as the ammonia is unloaded from tank cars. Equipment requirements are small; the process is simple and automatic. And it makes possible attractive savings for large-scale users of aqua ammonia in that it eliminates the cost of shipping four tons of water with every ton of ammonia. The process was developed at the Pittsburg, Calif., plant of Shell Chemical Corp. in answer to numerous requests from big ammonia users for a simple mixing system.

### How Process Works

Anhydrous ammonia, as it flows from tank cars under its own pressure, is mixed with an automatically controlled flow of treated water in a globe valve line mixer. The proportioning of the flows of ammonia and water by means of flow instruments was considered impractical because of the difficulties in accurately measuring two-phase flow. (Due to pressure drop in tank car fittings and line, a portion of the ammonia vaporizes as the pressure is reduced.)

Flow is therefore proportioned on the basis of the temperature rise resulting from the highly exothermic heat of solution. With this method of control, ammonia flows freely and uncontrolled from tank car to storage and is line mixed with a controlled flow of water; water flow is automatically adjusted to hold a fixed temperature after mixing.

The theoretical temperature rise, which occurs when anhydrous liquid ammonia at 68 deg. F. and water at 68 deg. F. are mixed, has been calculated for several aqua ammonia concentrations fro mthe thermal data of Jennings and Shannon[1]. These are given in Table I, and it may be seen that a temperature rise of 3 to 3½ deg. F. occurs for every 1 percent increase in ammonia concentration. (All percents are by weight.)

Table I—Theoretical Temperature Rise, Solution of 68 Deg. F. Anydrous Ammonia in 68 Deg. F. Water

| Wt. Percent Ammonia in Mixture | Temperature Rise, Deg. F. | Temp. Rise per Percent |
|---|---|---|
| 4 | 13.34 | 3.34 |
| 10 | 34.1 | 3.41 |
| 15 | 49.2 | 3.28 |
| 20 | 63.5 | 3.17 |
| 24 | 73.6 | 3.07 |
| 28 | 82.9 | 2.96 |

Next, a series of laboratory experiments were carried out to see whether absorption would be sufficiently complete (at the elevated temperature of the mixture) to give an accurate prediction of the concentration of the aqua ammonia produced. With experimental apparatus, aqua ammonia of strengths from 7 percent to 30 percent was produced at a rate of 0.2 gpm. Anhydrous ammonia, flowing from an inverted ammonia cylinder, was line mixed with water at a pressure of 20-30 psig., passed through a globe valve which dropped the pressure about 10 psi., and subsequently

cooled. No unabsorbed ammonia was present after cooling, as indicated by a dry gasmeter connected after the aqua ammonia collector. Ammonia concentrations, determined by specific gravity measurement, deviated an average of 0.7 percent from the calculated concentrations. The data obtained indicated that absorption of ammonia in water after the mixing valve is essentially complete providing that the pressure after the mixing valve is maintained 10 psi. or more above the vapor pressure of the aqua ammonia at that point. The system back-pressure required depends upon the initial temperatures of the water and ammonia, and the strength of the aqua ammonia produced. Vapor pressures of 20 percent aqua ammonia and anhydrous ammonia at several temperatures are tabulated in Table II.

Table II—Total Vapor Pressures, Psia.

| Temperature, Deg. F. | Anhydrous Ammonia | 20 Percent Aqua Ammonia |
|---|---|---|
| 40 | 72.3 | 2.26 |
| 50 | 89.2 | 2.95 |
| 60 | 107.6 | 3.84 |
| 70 | 128.8 | 4.94 |
| 80 | 153.0 | 6.32 |
| 90 | 180.6 | 8.05 |
| 100 | 211.9 | 10.2 |
| 110 | 247.0 | 12.7 |
| 120 | 286.4 | 15.7 |
| 130 | | 19.2 |
| 140 | | 23.4 |
| 150 | | 28.3 |
| 160 | | 33.8 |
| 170 | | 40.3 |
| 180 | | 47.8 |

A schematic flow diagram of a commercial installation for unloading anhydrous ammonia from tank cars and converting it to aqua ammonia as it flows to storage is shown in the sketch. Liquid ammonia flows from the tank car under its own pressure and is line mixed with a controlled flow of treated water. Ammonia flow is not controlled and varies during the course of unloading as tank car pressure drops. The mixture of anhydrous ammonia and water flows through a globe valve which serves to complete the mixing. Pressure drop across the globe valve is manually adjusted to 10 to 20 psi. A temperature recorder controller measures the temperature after the globe valve mixer and automatically maintains this temperature at a predetermined value by adjusting the water flow. Following the mixing valve, the aqua ammonia flows through a water cooler to atmospheric storage tanks. In locations where exceedingly cold water is obtainable, say 55-60 deg. F., the use of a cooler is not necessary. The quantity of cooling required will depend upon the initial water temperature, final ammonia concentration, and the losses which can be tolerated in storage; the latter will be a matter of economic balance. A back-pressure control valve is installed in the line to the storage tanks to assure a minimum back-pressure of at least 10 psi. above the vapor pressure of the aqua ammonia after the mixing valve. In order to minimize water hammer effects a high initial water pressure is recommended, say 60 psig. or 20 to 30 psi. above the mixing point pressure. The use of a sparger or eductor-type mixer also will aid in minimizing water hammer.

Table III—Theoretical Temperature and Pressure Profile During Tank Car Unloading

| Percent of Liquid Removed | Temperature, Deg. F. | Pressure, Psig. |
|---|---|---|
| 0 | 70 | 114.1 |
| 20 | 68.9 | 111.5 |
| 40 | 67.5 | 108.4 |
| 60 | 65.6 | 104.8 |
| 80 | 63.0 | 98.9 |
| 90 | 61.2 | 95.3 |
| 95 | 59.9 | 92.6 |
| 99 | 58.0 | 89.2 |

Unloading requires only one connection to the tank car. The vapor connection which is normally used to pressure the tank cars is not required; the vapor pressure of the ammonia is sufficient to displace the liquid from the car. However, with this method of unloading, tank car pressure and temperature vary during the unloading and a variable amount of flashing occurs in the liquid ammonia lines. As liquid is withdrawn from the tank car, ammonia vaporizes to displace the liquid and refrigerates the remaining liquid. Table III illustrates a theoretical temperature-pressure profile for typical unloading conditions calculated using Bureau of Standards Tables.[2] The data are based on the assumption that no heat enters or leaves the tank car and neglect the heat capacity of the steel tank. In practice, the actual pressure and temperature reduction will be somewhat less due to heat leak and the heat capacity of the tank car. Due to the change in tank car pressure, and a consequent variation in the amount of flashing in the lines and valves, ammonia flow will gradually decrease during the course of the unloading. This is of no consequence, however, since the water flow is automatically controlled to maintain a fixed temperature after mixing.

Prior to unloading, it is necessary to determine the required temperature after mixing. This may be calculated from water temperature, initial tank car pressure, and the desired aqua ammonia concentration. The necessary data for calculating the control temperature may be found in the "Tables of the Properties of Aqua-Ammonia Solutions" by Jennings and Shannon,[1] and "Tables of Thermodynamic Properties of Ammonia" by Bureau of Standards.[2]

Since 20 percent aqua is the most commonly used strength, values of the control temperature have been calculated for this concentration and are tabulated in Table IV for a range of water temperatures and tank car pressures. The control temperature for 20 percent aqua may be calculated, for the range of conditions given in Table IV, by the equation

$$T = 0.11P + 0.77t + 66$$

in which $T$ is control temperature in deg. F., $P$ is initial tank car pressure in psig., and $t$ is treated water temperature in deg. F.

Due to a variation in the temperature of the ammonia leaving the tank car during the course of unloading, there will be a minor variation in the concentration of the aqua ammonia produced. The maximum variation in concentration, based on the temperature and pressure profile in Table III, would be less than 1.0 percent; most of this variation would occur during the unloading of the last 20 percent of the ammonia. Average concentration can nevertheless be accurately predicted.

Typical installations using 3-in. piping for liquid ammonia flow and 4-in. piping for water and aqua ammonia flow permit the unloading of a 10,000 gal. ammonia tank car in six hours.

### Where to Get Data

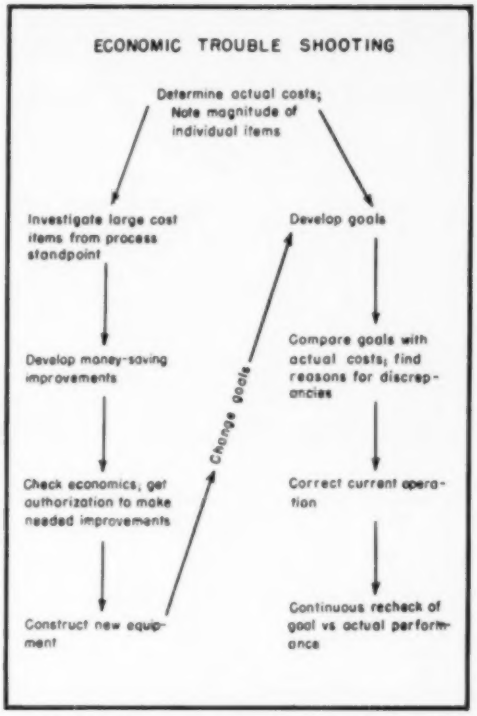
1. Jennings, B. H., and F. P. Shannon, "Tables of the Properties of Aqua-Ammonia Solutions." Lehigh University Studies, Science and Technology Series, No. 1, 1938.
2. Bureau of Standards Circular No. 142, "Tables of Thermodynamic Properties of Ammonia," April 16, 1923.

Table IV—Control Temperature After Mixing Valve to Produce 20 Percent Aqua Ammonia, Deg. F.

| Inlet Water Temp., Deg. F. | Initial Tank Car Pressure, Psig. | | | | |
|---|---|---|---|---|---|
| | 60 | 80 | 100 | 120 | 140 |
| 40 | 102.3°F. | 105.9 | 108.1 | 110.1 | 112.0 |
| 45 | 107.1 | 109.7 | 112.0 | 114.0 | 115.8 |
| 50 | 111.8 | 113.5 | 115.9 | 117.8 | 119.6 |
| 55 | 114.8 | 117.4 | 119.7 | 121.6 | 123.4 |
| 60 | 118.6 | 121.2 | 123.5 | 125.4 | 127.2 |
| 65 | 122.4 | 125.1 | 127.4 | 129.3 | 131.0 |
| 70 | 126.2 | 129.0 | 131.2 | 133.1 | 134.9 |
| 75 | 130.1 | 132.8 | 135.0 | 137.0 | 138.8 |
| 80 | 134.0 | 136.6 | 138.8 | 140.8 | 142.6 |
| 85 | 137.8 | 140.4 | 142.6 | 144.6 | 146.4 |
| 90 | 141.6 | 144.2 | 146.4 | 148.4 | 150.2 |

# Economic Trouble Shooting

Presence of high break-even points indicates need for an inventory of the economies of each process and plant unit and correction of existing defects.




PROCEDURE recommended for the most efficient investigation of a plant or process is diagrammed in chart above.

**William H. Tell**
*Shell Chemical Corp.*
*Houston, Tex.*

SOARING costs have pushed the "break-even point" of many plants near their capacities. This has focused a glaring spotlight on a vital need—to accurately know the economics of each process and plant unit.

An "ailing" or "sick" process may well mean the difference between profit and loss. However, prompt diagnosis of the situation, with a follow through of sound corrective measures, may help to guard a plant against the day when salesmen are no longer simply order-takers—the days of downright competitive production and selling.

In investigating a plant or process, the first step is to know what the actual operating costs of the plant are. This sounds like a truism; obtaining accurate cost information is one of the primary problems confronting management. The trouble is that frequently a great deal is lacking in the cost information management receives. Primarily, this is due to the practice of establishing cost accounting procedures that fail to give sufficient weight to important technical aspects of the processes involved. Too often, the only real consideration given is the accuracy of the procedure from an accounting viewpoint. This can distort the results by allowing various short cuts, factors and the like.

Fundamentally, of course, this faulty situation can be laid at management's door for its tendency to adopt the attitude that individual components of a plant are doing well when the plant as a whole shows a profit.

### Getting Accurate Costs

Here is a program that should achieve the goal of accurate cost information:

1. Establish a desired degree of accuracy for the final costs desired.

2. On the basis of this desired accuracy, critically review and, if necessary, reestablish the cost accounting procedures for the unit under scrutiny. In some cases it may be necessary to review several units to be certain the process costs charged against a particular unit are accurate. An experienced engineer, working in conjunction with the cost control section, should do the reviewing. His recommendations should be accepted on the broad procedural aspects of the chemical process.

Responsibility for such items as depreciation and amortization naturally belongs and should remain with the accounting department.

3. After establishing satisfactory accounting methods, they will be beneficial only if maintained up to date by

a group independent of the operating and accounting sections. This is desirable because the operating departments, while concerned with maintenance of the variable process costs at a minimum, have primary responsibility for production, which generally keeps them well occupied. Accounting departments are usually overburdened with maintaining daily statistics, and frequently in such a situation management is provided with basic cost information from individuals whose restricted technical knowledge may result in misinformation.

### Standard Costs

One system of cost control, not fully utilized in the chemical process industry, is the establishment of a standard unit cost. To be of most benefit in controlling manufacturing costs, this "ruler" should be composed only of direct costs which are under the control of the operating personnel. Such fixed and indirect costs as land rental, insurance, depreciation, and interest should not be included. If they are, they mask the main objective: a workable method of comparing actual production costs against a goal.

Often, standard costs of this type are calculated on the basis of a goal—they represent the lowest, practically-achievable cost that the operating department should be able to reach. Because of this, they are often called "goals." In establishing such goals, chemical equilibrium and normal handling losses must be taken into consideration. Otherwise, the standard is merely a theoretical cost, without any real significance.

The component parts of the goal cost should consist of (1) the value of raw materials, (2) catalysts, (3) normal operating labor, (4) maintenance, and (5) utilities. Establishing the goal for many of these items is relatively easy. One of them is a real problem—maintenance.

Establishing the basis for a maintenance goal is open to many approaches. One method is to deduct the annual interest on the capital investment from the annual actual depreciation rate (not the rate established for taxation purposes). This net sum represents the amount of money available each year for maintenance. This concept of evaluating maintenance costs can be justified on the basis that if physical deterioration of the plant did not occur the only reason for its retirement would be obsolescence. (For another method, see *Chem. Eng.*, Apr. 1948, p. 272.)

By using such a standard it is possible to improve the basis for judging cost efficiency of the process under consideration. From a cost standpoint, it also permits an easy routine check and interpretation of the process. From a comparison of this type the causes of high costs can be isolated and corrective measures taken.

### Process Study

If a process, when operating at peak efficiency, still is high cost a third step may be taken. That step is a survey of the process to consider changes that will result in improved costs.

In reviewing a process, looking for changes that will cut costs, here are some items which bear watching:

*Time*—In a sense, all profit is derived from time. This frequently is not credited for its full influence, and any method of reducing the time requirements of an operation or process is generally valuable. For example, take the breaking of vacuum on large batch dryers or evaporators. In some cases it may be possible to substitute a condensable material, such as steam, for a non-condensable material, such as air. This change can often result in adding one cycle per day without expensive equipment changes. Costs for such added production are all out-of-pocket, so the increase in profits can be far larger than the increase in production would indicate.

*Control Limits*—Too stringent control limits can hamstring a process, and sometimes unnecessarily. The best approach here is to analyze the requirements of the consumers of the products. Often a large percentage could use the product with less stringent specifications, offering a possibility of producing two grades and increasing over-all output. Often, too, in equipment releasing large volumes of dilute solutions a substantial saving can occur for every decrease of even 0.1 percent in the concentration of the valuable material lost from the system.

*Raw Materials*—Investigation may show that minimum cost raw materials are not being used. For example, in the petroleum industry various crude oils are available for a refinery to process. In general, lower specific gravity material commands a premium price, since it contains more straight run (naturally formed) gasoline. With modern catalytic cracking and supplementary processes, a greater profit per barrel of crude can often be realized by charging crude oil containing less straight run gasoline. After a plant has been placed in operation and the initial economic evaluation prepared, it is not always kept up to date, resulting in this point being overlooked. The benefit of saving 5c. per bbl. on crude oil can be very significant, especially where a plant consumes more than 5,000 bbl. per day.

*Byproducts*—Where the unit value of a byproduct is low compared to the main product, it pays to investigate the possibility of recycle of the byproduct. It may be possible to shift the equilibrium in a way that will provide more of the most profitable product.

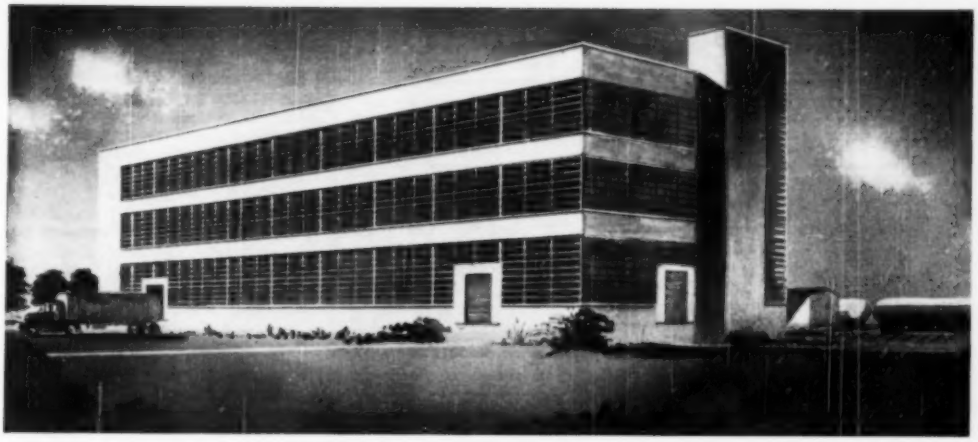
*Operating Pressure*—In vapor phase operations, operating at increased pressure gives a decrease in the theoretical equilibrium concentration for those processes where more products are formed than there are reactants entering the system. However, this is often more than compensated for by the increased contact time which allows a closer approach to equilibrium. Hence, the over-all picture may show a gain in production. Such a step is generally of benefit where a catalyst with a low activity coefficient is employed or catalyst activity is severely influenced by on-stream time.

*Heat Exchange*—Investigation may show that hot products are being cooled by an extraneous medium or that hot waste streams are allowed to leave the process at the same time heat is applied to a cold incoming stream. It is possible that additional heat exchangers may be justified.

*Utilities*—Often utilities are used in excess of actual requirements. An example is cooling water. Common procedure is to operate with all condenser water valves wide open. Since it is often impossible to obtain complete cooperation from operators in reducing excess consumption, one possibility is to reduce the plant water pressure. This often allows several pumps to be shut down without a bad effect on operation and results in a substantial saving.

In addition to the above points, there exists one intangible that makes or breaks the best mechanical design; that is the human factor. Without the cooperation of personnel actually engaged in operations, and unless they have the idea that they work with, not for, an organization, no plant will ever be fully successful. Hence, it is important that hazardous or disagreeable conditions affecting personnel be eliminated as soon as uncovered.

While much can be said about economic and process trouble shooting, in reality they coexist. The crux of the analysis and investigation of a unit is accurate cost information and interpretation. Until this is available any study of the economics of a unit is open to question, and any process changes made to rectify or improve a competitively disadvantageous position fall in the same category.



Architect's conception of the way the proposed standard building might appear.

Rational Methods Are Possible in

# Building Design for Batch Processes

Characteristics of most batch processes have similarities which justify the consideration of building standardization, thus leading to many advantages.

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Although standards are well developed for the design of many sorts of buildings including warehouses, laboratories and general plant production units, this is not true of buildings intended primarily to house batch chemical processes. Too frequently the batch process layout engineer is given building drawings developed with little or no regard for the specific demands of the equipment or the need for material flow. Both considerations, however, are vitally important in batch production work. This article, therefore, considers the basic needs in process buildings suitable for producing dyes, pharmaceuticals, certain resins and other polymers, as well as a large number of organic intermediates.

Rapid development of the synthetic organic chemical industry during and after the first world war was often accomplished by new companies in many cases with limited capital, which meant that equipment was recruited from every imaginable source and placed in any readily available space. Hence, this inherently batch process industry tended to grow up under a system which failed to realize the advantages of planning a building around the requirements of the process and equipment. Even today there are installations operated under severe handicaps, asking men to operate in poorly lighted, insufficiently ventilated areas which are crowded with equipment and provide inadequate room for proper operation and maintenance. Such conditions are rapidly being eliminated.

There is a definite trend in various state labor departments in recent months to insist on more stringent requirements for plant ventilation and increased safety measures. The hazards inherent in flammable and explosive gases, vapors and dusts, are attracting entirely too much attention to continue in a minor role in plant design.

Use of the term "standardization" in connection with building design naturally raises certain questions owing to the rather wide variation possible in process requirements, and the fact that one process will naturally require more floor height than a second. However, there are certain recurring features of batch process installations which justify consideration of standardization. It must be recognized at the outset that standardization implies a set of specifications which can vary slightly with relative size of equipment.

## Advantages of Standardization

Adoption of a standard process building offers many worthwhile fea-

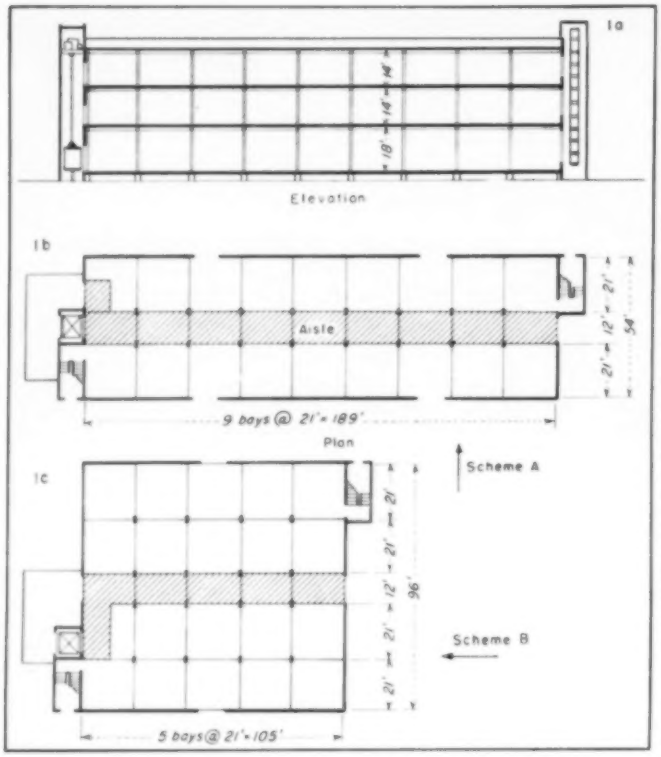



Fig. 1—Elevation of proposed standard batch processing building, with two of several possible floor plans; Scheme A emphasizes maximum possible vent area.

tures which can be enumerated as follows:

1. A standard design provides the design chemical engineer with a definite set of structural and mechanical factors upon which to base his development of the equipment layout and flow of materials. If building design is under way at the same time that the process is being laid out, complications and delays are frequently introduced. In effect, the use of a standardized building eliminates one complete set of variables well in advance of the demand.

2. The tedious but necessary thought that must be given to planning layout for various unit operations can be minimized by repetitive installations. Such operations might include refluxing or batch distillation, dissolving and recrystallization, batch weighing, clarification, disposal of filter cake, and so on. These installations can be designed more readily with a knowledge of the structure's limitations.

3. Both engineering costs and delays can be reduced through standardization. Because the details of mechanical installations are many, great savings in engineering costs can be made on the second and third units through repetitive location of service headers for steam, water, air, vacuum, lighting and sprinkler systems. The same applies to effluent systems, laboratories, wash rooms and offices. To a large extent, ventilation can be predesigned, almost without reference to eventual process demands. This consideration applies also to transformer stations and major power distribution panels.

4. Standardization permits lower construction costs. Repetitive operations insure greater efficiency in the use of materials and labor.

5. Since building materials can be ordered and construction started even before the process details are completely developed, standardization can increase the speed of construction, often an important time saving device for manufacturers who are anxious to supply new market demands ahead of their competitors.

6. Through building standardization it is possible to develop a master plan for the entire manufacturing area, to include sewers, power lines, water mains, roadways, process effluent systems, storage areas and many other items. Such systems can be sized and arranged to assure adequate capacities and efficiencies in the fully developed site.

7. Consistent external design improves general plant appearance. This factor is becoming more important in the minds of management. Each year the beneficial effect of good plant appearance on the employee and his attitude toward his job becomes more apparent.

The advantages for standard design enumerated here seem to outweigh by a large margin any disadvantages that have come to the writer's attention. It must be recognized, of course, that not all pieces of equipment ultimately required will fit into the spaces provided with greatest efficiency. Also, in providing for all reasonable contingencies in general use, there may be instances where the steel frame will be over-designed, the floor heavier, or the safety precautions more carefully worked out than some particular process may seem to justify.

## What To Consider

Before the general features of the contemplated design are described, it will be wise to set down some of the considerations concerning the process, as well as those placing limitations on the building design. Under process considerations we should note the following:

1. This design is intended primarily for batch processes, a preponderance of which will be organic syntheses and allied auxiliary steps.

2. The equipment size and shape will vary with the type of product to be produced, but there will be certain major units around which the auxiliary equipment normally will be placed. Consideration must be given to the facility with which this equipment may be rearranged and re-piped for flexibility in process changes, and new product requirements.

3. Careful control and identity of each batch can influence plant layout. Hence, the building should tend to establish working levels or areas which will facilitate centralization of such control, improve labor efficiency and reduce equipment hold-up time.

4. Batch processes, because of the greater frequency of materials handling, and often because of the wider variety of materials used, tend to accentuate the basic hazards of explosion, fire, toxicity and corrosion. The

possible presence of such hazards is an important consideration affecting both the process and the building.

5. Efficient materials handling in batch processes can contribute greatly to reduction in operating costs. A general plan for materials handling can be incorporated into the consideration of the standard building design.

Several important factors place limitations on the building design:

1. Safety considerations in design can have an appreciable influence on insurance ratings. To meet the recommendations of safety groups, including not only the insurance rating agencies, but also city, county and state labor and safety departments, it is sometimes necessary to effect a compromise with the process design engineer's desires.

2. The most efficient design for a standard building is the one which will best accommodate the greatest number of processes. In certain individual cases, therefore, there may be some small loss of plant efficiency as a result of compromise.

3. Construction costs necessarily influence building design. What value the initial cost can bear in relation to the operating cost and rate of amortization must be decided by the individual plant management concerned. However, it is a questionable policy to allow building costs to exert too great an influence on design. One company engaged in this type of process work recently reported that the sum of three annual cost items affecting the building, including retirement of capital expense on the building, real estate taxes, and insurance, comprised only 3 to 5 percent of the total cost of operation.

4. Somewhere in the early considerations leading to the design of a standardized building, it must be recognized that certain operations are inherently too hazardous to include within any building. Oftentimes solvent recovery systems for example, can be located advantageously outside the main process building. In some cases it has been found economical to locate all of the volatile solvent distillation in an entire plant within a central area, employing a minimum of equipment housing and a maximum of precautions designed to meet potential hazards. Grouping of such units in a central location usually warrants use of operators of high calibre and specialized training. On that account both safety and operating efficiency reach their highest peak.

Sometimes the grinding of dusty, abrasive, toxic or potentially unstable materials can best be achieved in an isolated building constructed of inexpensive materials and designed for that specific purpose. Although removing such operations from the rest of the process increases the materials handling problem, it frees the large units from the main hazard, and prevents many difficulties in housekeeping. An extremely important consideration is that, if one of these isolated units should be involved in an accident, the rest of the process will have a chance to carry on.

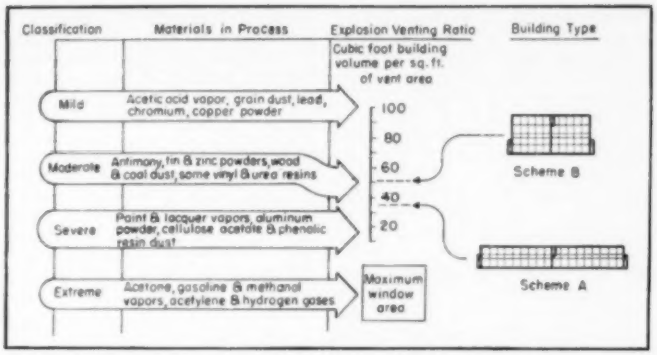



**Fig. 2—Diagram of explosion hazard ratings proposed by NFPA, indicating how double buildings of the Scheme A and B types would rate according to the system.**

Serious as the problems just mentioned may be, it is sometimes impossible to divorce them from the plant layout. In such a case, there is no real alternative: the building in that case must contain every feasible element in its design to provide real protection.

## The Standard Building

Although single-story buildings can be built at lower cost, a multi-story design is suggested for the batch process building since, with materials in process handled batchwise, there is a distinct advantage in providing three operating levels.

An elevation of the proposed standard building appears in Fig. 1a. The building employs three levels with the first floor set 4 ft. above the railroad track and driveway. The second floor is 18 ft. above the first and the third floor 14 ft. above the second. The roof is another 14 ft. above the third. The plan indicates a fireproof stairway tower at either end of the building.

The third floor is intended primarily as a raw materials storage and charging area, and to provide a place suitable for locating equipment for the isolation of filter cakes. So many batch processes comprise a series of steps of dissolving, reaction, precipitation and isolation, that there is a real advantage in isolating the product at a point above the dissolving vessels and so minimize handling of wet or semi-wet filter cakes. This level can also be used for shift or 24-hr. storage tanks which are used in conjunction with smaller pre-weighing or measuring tanks on the lower levels. These storage tanks can be filled periodically and thus simplify the need for numerous pump-starting stations. In most cases there will be a considerable saving in piping. One of the time consuming factors in batch work is the pre-weighing of solid materials for charging. This level should facilitate the pre-weighing of batches which can then be held in readiness in hoppers or containers until the need for them arises. Operation in this fashion has resulted in increased labor efficiency and a reduced materials handling problem in a number of cases.

It is contemplated that the second floor will be a focal point for the entire operation. Here the major reaction equipment will be located, for such purposes as condensation, reduction, hydrogenation and many other steps that must be closely controlled for the maximum in yield and quality of the product. Locating such operations on the second floor, along with the necessary control panels and control devices for material feeding, tends to keep the chief operator on one level and enables him to concentrate his attention time on what will generally be the most critical point in the process. This also has the effect of defining his responsibilities more closely. On this floor it is possible to feed raw materials to the reactors through the open manholes if for any reason materials cannot be handled safely from the floor above.

By dropping the primary reaction vessels through the second floor, the first floor thus becomes an area which serves primarily to receive the product

of such reactions. The discharge from these vessels can go directly to pumps, dissolving tanks or crystallizing tanks set on the first floor. Access to the discharge of the reaction vessels can be accomplished readily by establishing semi-permanent platforms of lightweight structural steel and steel grating, located about halfway between the two floors. Since this intermediate level is not required for all operations and will depend on exigencies of the process, it is convenient to have the vertical columns pre-punched at the time of construction to facilitate installation of steel for the working platform if it should be needed. In this way, such platforms can generally be installed if required at a later date, usually without interrupting plant operations.

The choice of an 18-ft. elevation at this point is debatable, but it does permit the installation of fairly large dilution tanks which are more conveniently located on the ground floor. It also enables receiving tanks to be positioned beneath the primary reactors without crowding or limiting pipe assemblies between these two pieces of equipment. This height is also generally adequate for most drying operations which include batch dryers, small flash dryers, or even small rotary dryers which can be fed from the second floor with a hopper, and still permit a packaging unit to be located beneath the dryer.

It should be noted that the overall elevation inside the building is about 46 ft. This height is enough to permit installing steam jet vacuum equipment and its accompanying barometric leg. One of the real advantages is that this leg can be submerged in a hot well located above the first floor. Low maintenance, greater safety and ease of operation all result from keeping this piece of equipment above the first floor level. The height of the building is also enough to permit the installation of many kinds of small stills, refluxing columns, dust collection systems and other tall equipment.

### Building Plan

It is inherent in batch process work that a series of operation steps in many pieces of equipment will ordinarily be required. It is desirable to provide aisle-ways close to each step in the process to facilitate materials handling. Furthermore, whenever possible the equipment should be arranged so that the material in process moves toward the ultimate areas assigned to finishing, packaging and shipping. To permit freedom in arranging equipment and piping, areas intended primarily for equipment installations should contain as few vertical obstructions as possible. From data developed in structural design, a 21 x 21 ft. unit has been found to be most suitable as the "working" bay, while an aisle of 10 ft. clear width is provided to service these bays.

The plan does not make provision for offices, laboratories or employee facilities because of the many variables which accompany each particular case. Depending on local requirements, no particular problem will be encountered in locating such areas in the building proper, in an annex, or in a separate building.

Over-all dimensions of the building were chosen after considering the effect of various state labor codes. Some states have definite limitations on the amount of area which can be placed between fire walls. The plan shown assumes an area of approximately 30,000 sq.ft. which can, of course, be secured by various arrangements of the basic bay. Fig. 1*b* shows a long narrow building arrangement, and Fig. 1*c*, a substantially square arrangement, both of about this size. To double the available area, it is possible to place two of these basic plans end to end separated by a firewall, as suggested at the right of Fig. 2. Should greater multiples of the basic 30,000 sq.ft. be required, this process of addition can be repeated by placing the elevators on the side walls instead of the ends.

The two plans sketched in Figs. 1*b* and *c* indicate two extremes of the basic arrangement. Generally speaking, factory areas tend toward square buildings as in Scheme *B* but, as will be shown, the limitations on buildings introduced by the type of process to be housed may favor a shape as in Scheme *A*, for example, when the process employs volatile solvents or other substances having a potential explosion hazard.

### Influence of Hazard

The National Fire Protection Association has recommended a method of rating buildings according to the explosive potentiality of the materials being used, and the allowable free vent area designed in the building. Free vent area is taken to mean those sections of walls and roof which are capable of being blown out at a pressure of less than 300 lb. per sq.ft. This figure has been arbitrarily chosen to provide the necessary protection to operators and equipment. As a matter of fact, studies made in England in bombing raids during World War II demonstrated that the human body can withstand a pressure of up to 5 psi., which is over twice the pressure assumed in the NFPA studies. In the standard building discussed here, emphasis is placed on the window area in the walled section, without dependence on blow-out panels in the roof. It is proposed that this window sash be provided with scratched panes to reduce the inherent strength of the glass.

This particular insurance group has established a classification of materials according to relative order of explosive intensity. Materials are classified from "mild" to "extreme" and for each classification the group has recommended a specified maximum ratio of cubic feet of building volume for each square foot of vent area. Evaluating the two plans of Fig. 1 on this basis, we find that Scheme *A* has a ratio of 34 cu.ft. of building volume per square foot of window area, while Scheme *B* has a ratio of 41 to 1. When these units are doubled up as in Fig. 2 to give buildings with a combined working area of approximately 60,000 sq.ft., Scheme *A* remains close to the original figure with a ratio of 36 to 1, while Scheme *B* increases to over 50 to 1 as window area is lost through the combination.

Another variation of the basic design presented here would be to eliminate the two horizontal spandrels which encircle the exterior of the building at the second and third floor levels. Such a design would give side walls with continuous window sash and maximum area, and would provide vent area ratios of 28 to 1, and 33 to 1, for Schemes *A* and *B*, respectively.

### Building Details

*Frame*—Primarily, the frame of a building is a system of members designed to support the gross weight of the structure, plus the added weights of equipment and materials in process. A secondary quality desired in this structure is its ability to withstand a fire for a certain length of time without buckling or collapsing. The time limits have been defined by various fire insurance and safety group codes and generally these groups recommend for extremely hazardous locations the use of reinforced concrete frames, or a structural steel frame incased in a heat resisting coating such as concrete or masonry.

For the building considered here, we have avoided both of these frames for two reasons. In the first place, the standard structural steel frame has the highly desirable quality of facilitating equipment layout. Adding additional members to support new equipment, platforms or stairways, can most easily be accomplished on the exposed steel skeleton. The second reason lies in the almost mandatory use of a sprink-

ler system in manufacturing areas such as those considered here. A sprinkler system so enhances the stability of the steel frame that insurance rate setting groups are currently posting nearly identical rates for buildings with either an unprotected steel frame, or a reinforced concrete frame, provided the building contains an adequate sprinkler system. A dependable index of the risk can be obtained through such rating comparisons. (However, preliminary plans should be submitted to local code establishing groups before assuming that the type of design recommended here will be accepted in every case.)

*Floors*—What type of floor will be best suited will vary according to the type of production and the resistance such a floor must have to wear, corrosion and weight distribution. Here the standard design calls for a reinforced concrete first floor cast on well compacted dirt. There will be no depressions in this slab with the exception of the drain trenches running the length of the building on either side of the floor. The use of pits, sumps, service trenches or buried floor drains is to be avoided to prevent the creation of potential fire or explosion hazards. Ventilation of such installations is difficult, expensive and a headache to the maintenance department.

The second and third floors are also of reinforced concrete, but only in certain locations, such as areas to be set aside as aisles and heavily traveled work spaces. Other areas will be covered with steel grating or precast concrete slab units to facilitate the installation of new equipment or process piping.

Except for the aisles, floors should carry a greater than normal pitch to assure quick drainage of flammable or corrosive spillage. Most sidewalks are pitched 0.1 in. to the foot, and the floors discussed here should equal or exceed this figure. For locations where corrosion may be extreme, there are numerous suitable coverings that can be applied over the concrete floor. Design of the first floor contemplates a live load limit of 400 lb. per sq.ft. with a limit of 250 lb. for the second and third floors. Such ratings will permit raw material storage at any level.

*Heating and Ventilation*—The problem of ventilation is influenced materially by the probable presence of flammable and explosive vapors, dusts and gases in batch processing buildings. The ideal method of venting is to provide a series of duct systems which will remove the hazard at its source, employing the principle of high velocity for sweeping the area, together with large air volumes to dilute the material to a point below its lower explosive limit. An alternate method, however, is to move air across the entire operational area so as to provide 18 to 20 complete air changes per hour. In either case the ventilation system should be part of the original building considerations.

Whether by a master duct system, or through the use of fan-activated fresh air ports in the building wall, provision should be made to admit fresh air from a series of outlets along both walls, and running the length of the building. Preheating can be accomplished by fin-tube type heat exchangers in either intake system, with the final working temperature bolstered in severe weather by properly placed overhead unit heaters. Although such systems are relatively expensive to install and operate, they offer a reasonable, humane and economically sound method of reducing hazards of fire, explosion, toxicity and corrosion.

*Lighting*—Buildings for the purposes considered here should generally have vapor-tight or explosion-proof lighting fixtures. The general illumination plan should provide an intensity of 20 ft.-candles at working levels, with stairways, control panels and special working areas intensified through the use of auxiliary spot- or flood-lights.

## Building Costs

It has already been noted that the annual cost of buildings designed and constructed for the purposes considered here is relatively small in comparison with the cost of operation. Although this statement is true, the structure discussed will approximate 30 to 40 percent of the total appropriations for equipment and building, complete and ready for operation. It is instructive to examine the way some of the building design factors affect the final cost of the building.

*Bay Size*—The choice of a 21x21 ft. bay size for the working area offers a maximum utility of structural steel required for units of floor area approximating 400 sq.ft. Employment of continuous window sash in the wall is enhanced by the 21 ft. unit. Furthermore, from the standpoint of equipment installation, the 21x21 ft. unit permits supporting vessels up to 18 ft. in external diameter, as well as reaction vessels (such as the standard 2,000-gal. glass-lined vessels) which can be suspended through the floor side by side with enough space between to install common service headers for steam, cooling water, etc. It is an interesting fact that if the design presented here were reproduced using an 18x18 ft. working bay on either side of the main aisle, the loss in actual working space for process usage would be 26 percent, with a reduction in over-all cost of the building of only 9.0 percent. This fact emphasizes the value of the larger working bay, while still more point is given to it by the extra "elbow room" which expedites the work of process design, improves plant morale, makes plant housekeeping easier, and reduces the time required for maintenance work.

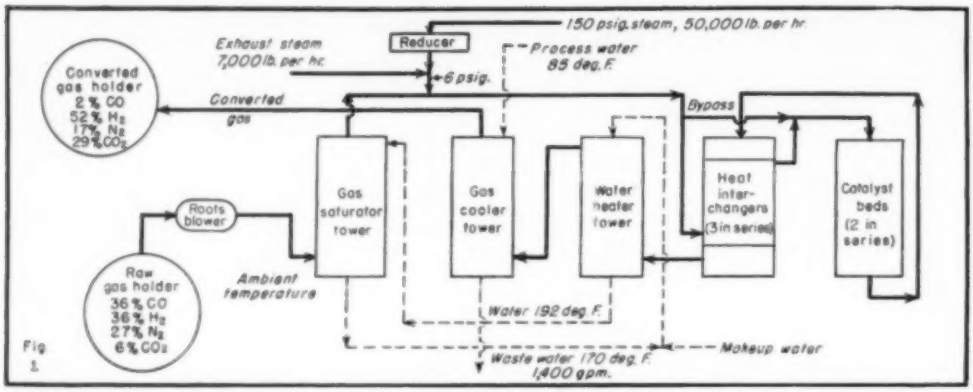
*Elevations*—The internal height of this building has been set at 46 ft. It is interesting to inquire into possible savings from reducing the height of one or more floors. A calculation of material and labor savings shows that a reduction of 2 ft. results in an over-all saving of only 1.1 percent, and of 4 ft., in lowering the building costs by 2.4 percent. Anyone who has skinned his knuckles removing agitator shafts from process tanks will question the value of savings as small as these at the expense of working headroom.

Examining the cost problem somewhat more closely, we can break the over-all cost of this design down into its component parts. Analyzing the plan of Scheme A, the percentage contribution to the total cost of each of the principle elements will be approximately as follows:

| Elements | Percent |
|---|---|
| Roof | 4.9 |
| Walls | 23.6 |
| Floors | 11.2 |
| Structural steel | 19.7 |
| Foundations | 5.6 |
| Mechanical services | 23.4* |
| Miscellaneous | 7.9† |
| Engineering | 4.9 |
| | 100.0 |

* Includes heating, vapor-proof lighting, ventilation for five air changes per hour, and plumbing.
† Includes elevators, stairs, etc.

In today's market, the actual cost of this building can be $10 per sq.ft. of operating area when built to the specifications outlined here. Hence Scheme A, with its 30,700 sq.ft., would cost $307,000 when built on a site with normal ground conditions. Multiple units of this design will show appreciable savings, however, if larger areas are required. This comes about through the use of a wall common to each unit, the repetitive use of engineering drawings, and economics in the mechanics of constructing larger buildings. For example, a building consisting of four basic units of the Scheme A type would probably result in a cost of about $9 or less per sq.ft., with additional savings if less than four elevators for the combined structure should be necessary.




Application of this scheme to a unit of conventional design and arrangement of equipment such as the one diagrammed above should result in a substantial amount of low-pressure vapor recovery by vacuum evaporation from hot waste water.

# Steam Economies

If you need low-pressure steam and have high-pressure and a stream of warm waste water, why not profit by this idea for economy of steam utilization?


**H. L. Thompson**

*Staff Chemical Engineer, Tennessee Valley Authority, Wilson Dam, Ala.**


AN APPLICATION of thermocompression for improving economy of steam utilization under certain conditions was devised for use in the TVA ammonia plant at Wilson Dam. The scheme was not carried out because of a change in steam balance due to other causes, but it is felt that the conditions required by the scheme probably exist in other plants and the application is outlined herein for possible use in such cases.

In general, wherever the design of a plant includes a source of high-pressure steam, a need for low-pressure process or heating steam which must be met therefrom, and a stream of warm waste water or solution, there exists the possibility of recovering profitably a portion of the required low-pressure steam by vacuum evaporation from the warm waste water and compression of the resulting steam vapor.

An application that would have been profitable will be illustrated by describing the original proposal for the TVA plant. Fig. 1 is a diagrammatic sketch of the CO conversion section of the ammonia plant, where the catalyzed gas reaction:

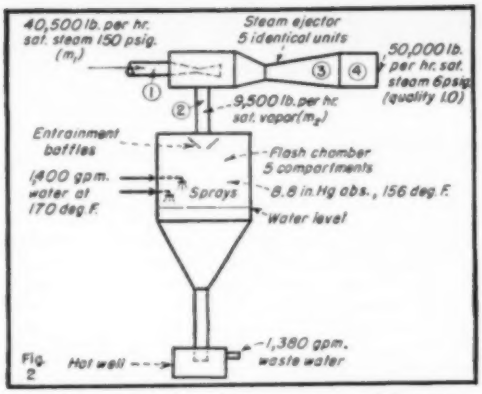
$$CO + H_2O = CO_2 + H_2$$

requires large volumes of process steam at 6 psig. The design of this unit is conventional and the arrangement of equipment as shown has been standard practice for a number of years. In spite of the rather elaborate heat conservation system comprising gas saturator, water heater and heat interchange vessels, a large portion of the energy input as steam and heat of reaction is dissipated in the final step of water cooling. In the TVA plant as much as was feasible of the 150 psig. steam destined for eventual low-pressure process use was passed first through prime movers for recovery of mechanical energy, but still a major part of this steam was being reduced directly.

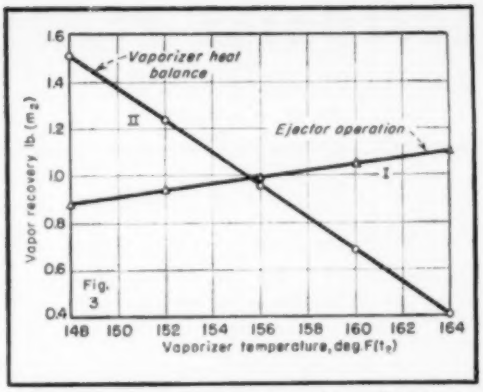
It appeared that a steam recovery system could be based on expanding the 150 psig. steam to process pressure through a steam jet ejector mounted over a vessel through which the hot waste water would be passed continuously, with resultant loss of vapor and reduction of temperature under the vacuum induced by the ejector. The vapor would be compressed to process pressure in the ejector.

Calculations after the manner of Dodge (Dodge, B. F., "Chemical Engineering Thermodynamics," McGraw-Hill, 1944, New York, pp. 289-293.) indicated that the scheme should be economically feasible, given sufficiently high over-all efficiency of commercially available ejectors. This latter was the principal unknown variable and the problem therefore was referred to a number of manufacturers of such equipment. Of three replies received, all made proposals for full scale application of the ejector scheme with assured recoveries of 9,000 to 10,000 of the 50,000 lb. of 150 psig. steam per hr. then being expanded. A typical arrangement as to equipment and operating conditions is illustrated in Fig. 2. Tentative prices quoted for equipment were less than $10,000 and it was estimated that installation would bring the total cost to not more than $15,000. The value of the steam to be saved was at least $30,000 per year so that the installation would have paid for itself 20 times over within a ten-year life; it was considered that

* Present address: Mississippi Chemical Corp., Leland, Miss.




Conditions required for satisfactory operation of the system in Fig. 2 are at point of intersection of the curves.




Arrangement as to equipment and operating conditions in a typical system. Savings are around $30,000 per year.

operating and maintenance costs would be negligible.

Vapor recovery and vaporizer temperature in this scheme are interrelated and are fixed by the initial and final conditions of a given problem. A simplified calculation for the conditions of Fig. 2 may be based on various assumptions as noted below. The theoretical minimum ratio of motive steam ($m_1$) to entrained vapor ($m_2$) is given by:

$$m_1/m_2 = (H_{2,4} - H_2)/(H_1 - H_{1,4}) \quad (1)$$

where $H_1$ = enthalpy motive steam (state 1) Btu. per lb. = 1,195.6*; $H_{1,4}$ = enthalpy motive steam after reversible adiabatic expansion to 6 psig. = 1,040; $H_2$ = enthalpy entrained vapor (state 2), Btu. per lb.; $H_{2,4}$ = enthalpy entrained vapor after reversible adiabatic compression to 6 psig. For present purposes it is satisfactory to assume that the actual motive steam requirement will be five times the theoretical, and since $m_1$ and $m_2$ are interdependent in that their sums must be 50,000 lb. per hr., equation (1) may be rewritten (quantities are divided by $10^4$ for convenience):

$$(5 - m_2)/m_2 = 5/(H_{2,4} - H_2)\ (155.6)$$
$$= (H_{2,4} - H_2)/(31.1) \quad (2)$$

or

$$m_2 = (155.6)/(H_{2,4} - H_2 + 31.1) \quad (3)$$

Thus $m_2$ is defined as a function of enthalpy at state 2, and consequently of vaporizer operating temperature. Values of $H_2$ (table) and $H_{2,4}$ (chart) in the arbitrarily selected temperature range of 148 deg. to 164 deg. F. are as follows:

| Temp. deg. F. | 148 | 156 | 164 |
|---|---|---|---|
| $H_2$ (quality (1.0) | 1,125.3 | 1,128.6 | 1,131.8 |
| $H_{2,4}$ | 1,272 | 1,257 | 1,243 |

The corresponding calculated values of $m_2$ for these temperatures are shown as curve I in Fig. 3.

Operating temperature is related independently to $m_2$ by a heat balance across the vaporizer. Enthalpy of the incoming water at 170 deg. F. is 68.5 (lb. per hr. $\times 10^{-4}$) $\times$ 137.9 = 9,450 Btu., and the outlet temperature will very closely approximate:

$$t_2 = 32 - (9,450 - m_2H_2)\ (68.5 - m_2) \quad (4)$$

which on rearrangement becomes:

$$m_2 = (11,640 - 68.5t_2)\ (32 - t_2 + H_2) \quad (5)$$

Calculated values of $m_2$ which satisfy this relationship are shown as curve II in Fig. 3. The point of intersection of these curves represents simultaneous solution of equations (3) and (5), and defines the required conditions: operating temperature of 155.7 deg. F. (8.70 in. Hg abs.) and vapor recovery of 9,750 lb. per hr. The manufacturers' slightly different conditions may reflect use of a somewhat higher factor for actual/theoretical motive steam requirement (about 5.2 as against 5.0 used in this example). The calculation given above is simplified to avoid individual efficiency assumptions for the three processes that occur within the ejector—expansion (nozzle efficiency), transfer of momentum, and compression, and to avoid trial and error estimation of the quality of the mixture at state 3 (diffuser section) (1), but a check calculation using the more rigorous method supports the conditions of Fig. 2 and 3.

In cases where the waste water is hotter, the required process steam pressure lower, or boiler pressure higher, the recovery will be better than in the preceding example, and for the reverse trends, less. For example, availability of motive steam saturated at 200 psig. and reduction of required process steam pressure to 18 psig., with other conditions and assumptions as in Figs. 2 and 3, should result in recovery of 11,400 lb. vapor per hr. at vaporizer temperature of 153 deg. F. Although a given ejector system is relatively inflexible as to capacity and its efficiency is affected greatly by changes in steam pressures and water temperature, these limitations mostly can be taken care of through design precautions. For example, the manufacturers' proposals as represented by Fig. 2 call for separate cells to give stepwise variation in capacity. Steam pressures may be controlled through conventional means, and in cases where the temperature of water or solution is subject to considerable variation, it may be controlled if necessary by bleeding in a small amount of steam, perhaps automatically. The source of low-level heat does not have to be a waste stream. Any hot process stream that needs, or may be subjected to, cooling and some evaporation should be satisfactory, and in such cases the evaporation may constitute an added benefit.

It is beyond the scope of this discussion to make detailed comparisons of the thermocompression proposal with alternative schemes for energy conservation that might be applied to the same problem, such as power generation for example, particularly since the comparisons depend so predominantly on local factors. However, a number of exploratory calculations indicated that for fairly wide ranges of such cost variables as electric power, boiler fuel, and ejector equipment versus generating equipment, the thermocompression scheme should be preferable in economy and simplicity.

* Thermodynamic data from Keenan-Keyes tables or Mollier chart.

# EDITORIAL VIEWPOINTS

*Sidney D. Kirkpatrick and Staff*

## Two Ways to Tighten Sails

MANY an executive, seeing "soft spots" developing in the national business scene, has been worrying about how to cushion a drop in his own business. Now, of course, we cannot hope to tell executives how to keep up profits in any prospective recession. But, we do want to caution against two unwise and unfortunate moves that some companies made in 1930.

When sales begin to slide there are usually two alternatives—cut prices and attempt to hold high volume sales at a lower income, or cut production and hold prices up. In the 1930's the latter was practiced more often than the former. We hope it will not be followed if a real recession is now in the making. If production can be held high, men stay on the payroll, still have purchasing power in the form of wages, and the whole deflationary spiral can well be held to a minimum. If production is cut, unemployment ensues and the downward spiral may be steeper, swifter, and more disastrous.

Another policy, which past history has demonstrated wise, is to maintain research at high levels. As times become poorer, the tendency is to cut expenditures that do not show immediate profit—and in some companies, research is often the first to get the axe. But, oddly enough, many of the world's greatest inventions have been made in hard times. Nylon is an example. Why? Perhaps, because of a feeling of insecurity, researchers work a little harder. Perhaps, because idle equipment is available, ideas that otherwise would be shelved temporarily can be tried on a plant scale. Every company wants to come out of a recession stronger than it went in. Maintaining research is one way of doing just that.

## New Fields for Fuel Technologists

CHEMICAL engineers have long been dominant in the technology of petroleum processing. No coke works can function without good chemical engineering. Now it is beginning to be almost equally important that similar service from our profession be used in other fuel industries, even the natural-gas division.

And it is equally true that chemical engineers in other process industries must watch production, transmission, and processing of natural gas as a vital and growing part of the fuel supply system of the country. There are a number of new projects developing in the utility divisions of the natural-gas business that are particularly intriguing.

One of the most unexpected of these developments is an investigation being made by the American Gas Association to study the fundamentals of gas flow at high pressure in pipelines. This has required new techniques in pressure measurement and recording. New hydraulic-testing tools are being developed. In one test a stainless steel tubing line of large diameter has been precisely made and honed inside to give a smooth inner surface of exactly uniform diameter for the test section of the line. Only with such superfinish is it going to be possible for the investigators to get the necessary precision of measurement which will permit accurate development of formulas for gas flow.

There are scores of other activities in the natural-gas industry that are worth watching. This is true for chemical engineers interested in many things beside fuel supply. In fact, we suspect that our profession will shortly be called upon for skilled talent to carry out some of the investigations which are proving so vital for the sound development of this process industry.

## "Hands Off" Says the Court

A MAJOR problem for any industrial firm supplying the government with goods or services on any basis but fixed-price bids is the question of "allowable" charges either for direct expense, overhead, or special service. Frequently the department or bureau served gets what it wants and finds that the charge is satisfactory, only to have complications develop in the General Accounting Office, which is the final audit agency. Many companies have discovered to their sorrow that an honest agreement fully carried out does not always have GAO approval and that frequently arbitrary deductions are made.

In one recent case of "Mathis vs. the United States" the federal court in New Jersey told the General Accounting Office to keep hands off. The audit review was apparently a mere routine, but led to a disallowance of certain intended payments which the Navy was willing to make. The contractor protested that GAO had no jurisdiction, as it was not a party to the contract nor named therein with right of review. The court approved this view and the Navy must now settle the claim, at least the contractor so hopes.

But the whole principle of government contracting by industry remains wide open and forecasts of future controversy are legion about Washington. Many firms have found that they dare not do business with Uncle Sam because of these difficulties. One very capable contractor recently cited to the Navy the reason for not closing a mutually acceptable agreement. He explained that, despite supposed "simplified" procedure, there is no practical way to meet all of the control ritual by any reasonable sum of money. This firm has assigned a full-time and very expensive clerk to the exclusive job of filling out forms and undertaking to meet procedural requirements. That has become in this case a direct charge, not mere overhead.

In one recent case seven different actions and 64 pieces of paper were required in connection with a very small contract. In one instance 18 copies of a certified statement were required. And after several months no settlement has yet been achieved despite compliance with every known rule, including many "silly" ones.

The only remedy yet suggested in this case to this particular contractor is to make the fee from 10 to 50 percent higher merely to cover auditing contingencies. Then the disallowances that occur from time to time will be made up by needlessly high charges on some other contracts; and thus the contractor will come out properly paid on all. Naturally no bureau or department likes this idea; nor do we.

## Exporting of Know-How

In "Point Four" of his inaugural address, President Truman stirred up many questions in the State Department, among journalists and elsewhere in industry, when he promised that the United States would undertake as a long-range project the export of know-how to assist in the development of backward areas of the world. We suspect that he did not visualize very precisely either a technique of action or the difficulties of accomplishment. But we are equally sure that a wise development of this broad concept may perhaps contribute more to international goodwill and to human progress throughout the world than any other single effort over a comparable period of time.

There are obvious difficulties in creating elaborate enterprises in the under-developed areas. Hence we listen with greatest interest and hope to one suggestion from the Department of Agriculture which seems to be a wholly workable first step in the export of know-how. We very much like Secretary Brannan's thought that backward agriculture in the rest of the world could very profitably and desirably be improved by utilization of the applicable methods which are available in the U. S.

America has multiplied many fold the effectiveness of human effort in production of food, clothing, and shelter through the application of science and technology. There is scarcely an area of the world where some of the benefits of this American advancement could not be applied either to lower the labor cost or to raise the productivity of the land.

The fact that relatively few of our methods could be lifted bodily from here for unaltered application elsewhere should not discourage us. Adaptation is obviously essential. But the adaptation will be no more difficult than has been the adjustment of American methods to suit the different climatic and soil conditions within our own country.

Chemical industries have a large stake in this undertaking. Fertilizers, pest-control chemicals, weed killers, and modern processing machinery are all integral parts of modern food production from the field to the kitchen. It will not be possible for some other chemical enterprises quickly to translate their domestic effort into a world-wide undertaking. But that will not excuse any of us for failing to consider the possibilities and to undertake those parts of the job promptly which do fall rightly within the range of early feasibility.

## Interlocking Industry

Seldom do we have a more striking example of the interlocking and interdependence of chemical enterprise than was recently furnished by an official action of the Secretary of Agriculture. This action was the determination of the sugar requirements for continental United States for 1949. The direct effect was important, because it practically fixed the supply (and the price) of sugar for the coming year. But the indirect effects reached alcohol, anti-freeze, methanol, ammonia, and fertilizers in a manner which we fear the Secretary did not at all realize.

By determining that continental United States did not need for consumption any more sugar next year than last, the Secretary limited shipments of both raw and refined sugar from Cuba to this country. This immediately necessitated plans for much greater molasses disposal by Cuba. It is obvious that this prospect of increased raw material affects the fermentation industries of Cuba and of the eastern United States.

Equally important, but less evident, are the effects beyond alcohol. This prospective new alcohol supply, of course, promises lower price and more abundant quantity for anti-freeze use. Thereby the inducement to make synthetic methanol for anti-freeze is greatly lessened. As a consequence, we suspect that the synthesis plants will put increased emphasis on ammonia, especially for fertilizer, where there is still a seller's market.

Thus these seemingly innocent rulings or restrictions often produce far greater effects than their makers anticipate. Chemical enterprise is intimately interlocked. The benefits or the dangers of official rulings may show up at remote points, apparently unrelated to the initial action. This fact must be constantly pressed in Washington and to state and local governments. Unless we who know the problem make this clear to officials we can expect unintended and far-reaching effects which may be quite unnecessary. Even the well intentioned official cannot act wisely if he is uninformed on the technical significance of his rulings.

## Where Do We Stand?

Many people honestly believe that this country is still pursuing a high-tariff, protectionist policy that is inconsistent with our status as a creditor nation. Undoubtedly some rates may still be unreasonably high, but the average is moving steadily downward. This is clearly shown in the following figures compiled by the Economic Research Department of the U. S. Chamber of Commerce:

| Period | | Equivalent Ad Valorem Dutiable | Free and Dutiable |
|---|---|---|---|
| Payne-Aldrich, 1910–13 | | 40.8% | 19.3% |
| Underwood, 1914–22 | | 27.0 | 9.1 |
| Fordney-McCumber, 1923–30 | | 38.5 | 14.0 |
| Hawley-Smoot, 1931 | | 53.2 | 17.8 |
| (Reciprocal Trade) | 1934 | 46.7 | 18.4 |
| | 1939 | 37.3 | 14.4 |
| | 1947 | 19.4 | 7.6 |
| (Geneva Agreements) | 1948 | 15.3 | 6.0 |

The same agency also points out that in the present state of world trade, tariffs are less important barriers than are import quotas, blocked currencies, unrealistic exchange rates and the unsound monetary and fiscal policies pursued by many countries.

# THE PLANT NOTEBOOK

*Theodore R. Olive,* ASSOCIATE EDITOR

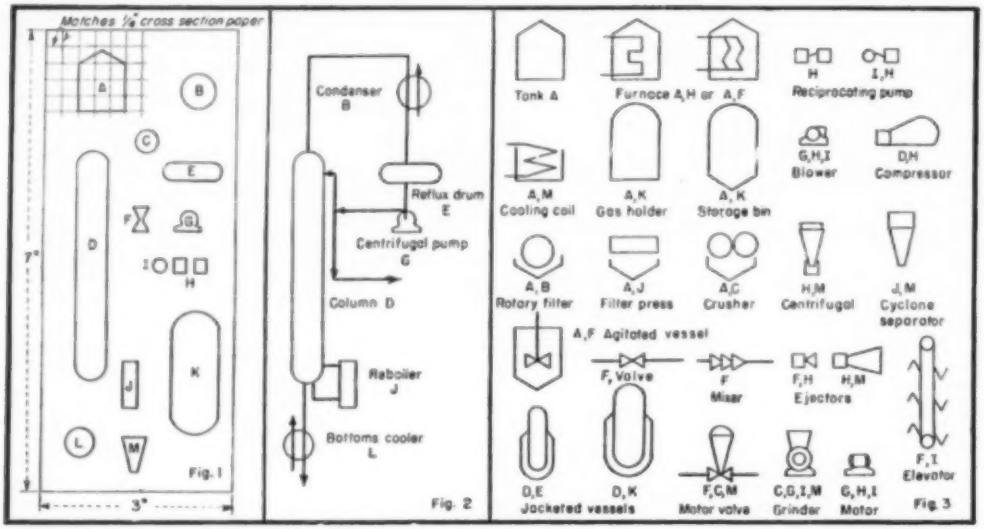



Fig. 1—Template for flow diagrams cut from clear plastic.
Fig. 2—One setting of template draws this column set-up.

Fig. 3—Here are some of the many standard symbols that can be drawn by combining various of the template symbols.

## Template for Flow Diagrams Draws Column Set-Up at One Setting

PAUL MUNK
*Chemical Engineer, Berkeley, Calif.*

★ **January Contest Prize Winner**

PREPARATION of flow diagrams is an everyday job of most chemical engineers. The template shown in Fig. 1 has saved many hours in preparing process design flow studies and at the same time has resulted in much neater sketches. It has proved its usefulness in drawing of flow diagrams for petroleum processing plants and should serve equally well in other chemical engineering fields.

The template is so arranged that a column with condenser, reflux drum, pump and reboiler can be drawn with the template in one position as shown in Fig. 2. The size of the template is so chosen that the symbols fit on ¼-in. cross-section paper, which makes it easy to put in flow lines to join the equipment symbols.

Fig. 3 shows some of the possible equipment symbols which may be obtained by combining the basic shapes of the template. The letters next to the symbols refer to the basic shapes used to draw the symbol. Practically all the equipment and instrument symbols required for chemical process flow diagrams can be produced.

The template can be easily cut from transparent plastic by tracing a drawing of the symbols.

**February Prize Winner**

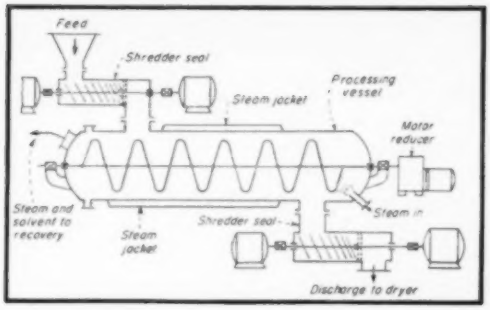
**A $50 prize will be issued to Herbert T. Bates, of the University of Nebraska, Lincoln, Neb., for an article describing a simple electrically operated diaphragm pump for corrosive liquids. This article will appear in the Plant Notebook for April. Watch for it!**

## How to Make Cement for HCl

PAUL C. ZIEMKE
*Engineer, Oak Ridge, Tenn.*

HYDROCHLORIC acid and its vapors can be considered the real "acid test" for pipe and joint cements. While there are a number of such cements available from several distributors, there is always a time when an emergency job finds one without them at hand. The ingredients for two good cements are practically always available.

Compound No. 1 consists of 1 part rosin, 1 part sulphur and 2 parts fireclay well mixed to a smooth texture. Compound No. 2 is made from 10 lb. of "flock" asbestos, 8 lb. of red lead, 80 lb. of litharge, and 6 qt. of boiled linseed oil. For this batch a mechanical mixer is recommended, with the dry ingredients poured in slowly, accompanied by light pourings of the linseed oil. Storage is best in a pressed top can to prevent oxidization and evaporation.



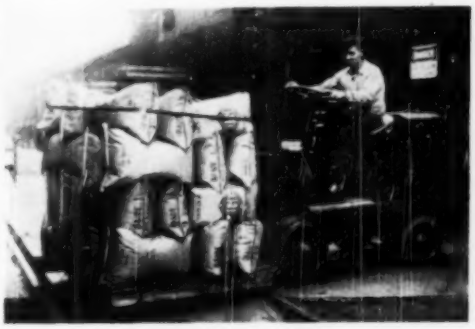

## Single Step Process Replaces Three In Processing Extracted Oil Seed

JOHN F. SCHNACKY
*Fischer & Porter Co., Buffalo, N. Y.*

IN THE conventional method of processing flakes from which oil has been removed by solvent extraction, four steps are used to prepare a toasted flake ready for drying, cooling and packing for animal feed. The writer has developed a single-step process which accomplishes the same purpose.

In the usual process the extracted grain flakes are first desolventized in a series of tubular dryers with steam jackets. This operation leaves a trace of solvent in equilibrium with the solvent laden atmosphere in the dryer, which is removed by blowing live steam through the flakes in a deodorizer. The solvent vapors from both steps are condensed and the water separated by decantation. The flakes with 20 percent water (wet basis) and at 250 deg. F., now free of solvent, pass to a toaster which destroys an organic poison present in the flakes and gives a toasted brown color psychologically desirable to the buyers. The flakes from the toaster, at 280 deg. F., and with 25 percent water, are reduced to 8 percent moisture in a dryer and cooled to 110 deg. F. in a cooler. They are then ready for sifting, bagging and shipping.

The proposed method combines the desolventizing, deodorizing and toasting steps in a single piece of apparatus by use of a steam jacketed dryer tube operating under 50 to 90 psi. pressure. The method is made possible by use of the author's "shredder seal" previously described in these pages (*Chem. Eng.*, Aug. 1948, p. 124), which allows continuous feed and discharge under pressure. The dryer tube is provided with dished ends, a conveying and mixing spiral and a superheated or saturated steam inlet at the flake discharge end. Flakes flow counter to the steam and vaporized solvent and are discharged in desolventized, deodorized and toasted condition to a conventional dryer and cooler. The steam-solvent mixture can be handled economically by a two-stage condensing method described by the author in *Chemical Engineering* (Feb. 1948, p. 142).



## Unit Load of Bagged Materials

WHAT appears to be a new way of handling bagged materials for shipment on pallets has been put into use by International Graphite & Electrode Corp. at St. Marys, Pa. The bags are stacked square in pairs on wooden pallets, each pair perpendicular to the adjacent pair. An adhesive between bags helps prevent slipping. The top layer of bags is steel strapped to hold the entire load firm. This method is an extension of the company's previous use of palletized unit loads for the shipment of graphite electrodes.

## Inhibited Acid Cleans Heating Coils

H. D. McAFEE
*Associate Professor, Chemical Engineering*
*North Texas Agricultural College, Arlington, Tex.*

EVAPORATORS are used to supply make-up feed water for nine boiler houses. The raw feed water has a hardness of approximately 4 grains per gallon and periodically the coils become coated with a tough scale. The copper coils for each unit are so closely spaced that sharp cutting tools cannot be used to dislodge the scale. Accordingly, when a coil is to be cleaned, it is removed from the evaporator and submerged in a cleaning solution for a period of 12 hours. The scale disintegrates to the point where it becomes

**$50 CASH PRIZE FOR A GOOD IDEA!**

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e. g., the March winner will be announced in April and his article published in May. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at our usual space rates.

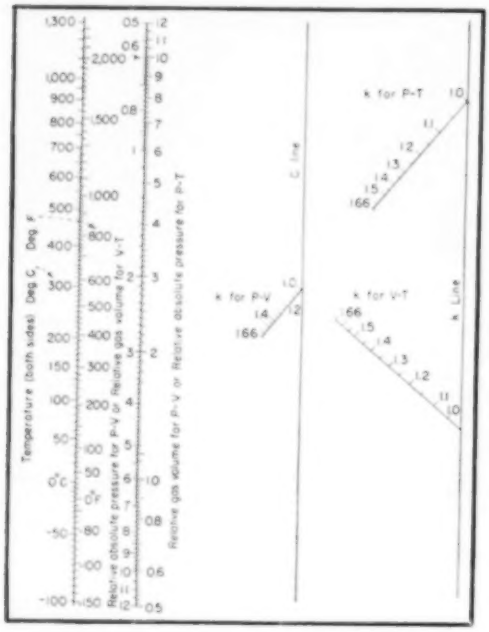
Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries.

Also, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

loosened and the remnants can be removed by air lance.

The cleaning solution consists of 14 percent hydrochloric acid (technical grade), 83 percent water and 3 percent aniline which acts as an inhibitor. The vat for this solution is a joint of vitreous clay pipe set upright in concrete. The concrete is covered with asphaltic material. A hoist is provided for raising and lowering the heating coil. The vat is emptied by means of a siphon.

The inhibitor prevents reaction between the acid and the steel head and spacers.




## Nomograph Calculates P–V–T Relations Of All Perfect Gases

GEORGE E. MAPSTONE

*Chief Chemist, National Oil Pty. Ltd., Glen Davis, N.S.W., Australia.*

SOLUTION of the adiabatic gas equations, which involve the ratio $k$ (the ratio of specific heat at constant pressure, to that at constant volume), can be handled conveniently by means of a nomograph given here. It solves the equations:

$$P_1V_1^k = C_1 = P_2V_2^k \quad (1)$$

$$T_1V_1^{(k-1)} = C_2 = T_2V_2^{(k-1)} \quad (2)$$

$$T_1P_1^{\frac{(k-1)}{k}} = C_3 = T_2P_1^{\frac{(k-1)}{k}} \quad (3)$$

The nomograph can also be used to solve *P-V-T* problems at constant temperature, pressure and volume.

For convenience in use, the nomographs for each of the three equations are superimposed on the one drawing. Relative rather than absolute volume and pressure scales have been employed in order to obtain a reasonable range of values without sacrificing accuracy.

Use of the nomograph is best illustrated by means of some examples.

1. *P-V Relations*—Ethane ($k = 1.20$) at 1,200 psia. is to be expanded to 200 psia. What is the volume change if the expansion is (*a*) adiabatic and (*b*) isothermal?

(*a*) Take the initial relative volume as 1.0. Connect 1.0 on the *P-V* volume scale with 1.2 on the *k* scale for *P-V* and extend to the *k* line. Take the initial relative pressure as 12.0 and connect this point on the *P-V* pressure scale with the point on the *k* line to cut the C line. Since 1,200 psia. is taken as 12 relative pressure units, 200 psia. will be 2 relative pressure units. Connect 2 on the same pressure scale with the point on the C line and extend to cut the *k* line. Connect this new point with 1.2 on the same *k* scale and produce to cut the volume scale at 4.45. That is, the gas volume will be increased 4.45 times by the expansion.

(*b*) Repeat the procedure outlined above using the value $k = 1.0$ instead of 1.2. This gives the result $V = 6.0$. By a similar procedure the pressure change for a given volume change can be calculated.

2. *V-T Relations*—Ethane ($k = 1.20$) at 250 deg. C. is to be expanded adiabatically to 4.45 times its initial volume. What will be the final temperature of the gas?

Take the initial volume of gas as 1.0 and connect 1.0 on the *V-T* volume scale with 1.2 on the *V-T* *k* scale and extend to the *k* line. Connect this point with 250 deg. C. on the temperature scale to cut the C line. Now connect $V = 4.45$ with $k = 1.2$ and extend to the *k* line. Connect this point with the point previously obtained on the C line, and extend to the temperature scale which it cuts at 114 deg. C.

By a similar procedure the volume change for a given temperature change can be calculated.

*V-T* relationships at constant pressure can be obtained from the nomograph by using the point $k = 1.0$ for *P-V* instead of a *k* value on the *P-T* *k* scale.

3. *P-T Relations*—Ethane ($k = 1.20$) at 250 deg. C. and 1,200 psia. is expanded to 200 psia. What is the final temperature?

Connect 12 on the *P-T* pressure scale with 1.2 on the *P-T* *k* scale and extend to the *k* line. Connect this point with 250 deg. C. in the temperature scale to cut the C line. Then connect 2.0 on the pressure scale with 1.2 on the *k* scale and extend to cut the *k* line. Connect this point with the point previously obtained on the C line and extend to cut the temperature scale at 115 deg. C.

By a similar procedure the pressure change required for a given temperature change can be calculated.

*P-T* relationships at constant volume can be obtained from the nomograph by using the point $k = 1.0$ for *P-V* instead of a *k* value on the *P-T* *k* scale.

## Measuring Current in Electrolytic Work

MEASUREMENT of the heavy d.c. currents used in electrolytic chemical plants has always offered troublesome and sometimes hazardous problems since, of course, transformers cannot be used and it has usually been necessary to employ long leads from the large shunt in the main bus to the meter which measures the shunt voltage drop. Westinghouse engineers have recently used a new method employing a device called a Transductor. This device is a special current transformer of the through type, which replaces the massive shunt. The direct current to be measured flows through the primary, while a low a.c. potential such as 110 volts flows through the secondary. A change in d.c. flow affects the reluctance of the magnetic circuit and alters the a.c. flow, which can then be measured with a conventional ammeter calibrated in terms of the primary d.c. flow.

WOULDN'T YOU LIKE to say

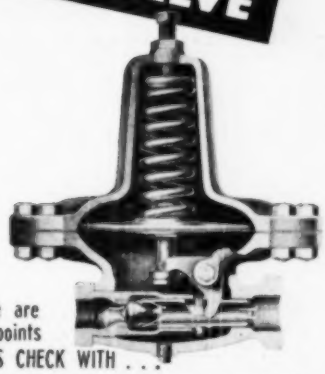
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"We have confidence in the performance of the CASH STANDARD '1000' and USE IT EXCLUSIVELY with oil firing control assemblies."
*—from an Engineering Corporation*

"The two CASH STANDARD Type '1000' pressure reducing valves that we use have, since their installation, GIVEN PERFECT OPERATION WITH NO MAINTENANCE."
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"The CASH STANDARD Streamlined Valves we have are DOING A SPLENDID JOB. WE CAN NOT RECALL ANY MAINTENANCE ON SAME AS YET. Some have been IN SERVICE 4 OR 5 YEARS."
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"We have two of these valves in operation on air pressures of 130 lb. and HAVE FOUND THEM TO OPERATE SATISFACTORILY on this pressure down to 60 lb., which are the only pressures we use."
*—from a Manufacturer*

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# Pickle Liquor Utilization

*Article on Page 112*

THIS is a new process just installed by the Wheatland Tube Co.; it gets rid of spent pickling acid at a profit. Also, it upgrades a second waste, zinc skimmings from galvanizing tanks, which otherwise has very little value. Raw materials are these two wastes and chlorine. Products are ferric hydrate pigment, solid zinc sulphate, zinc chloride solution and some metallic zinc screened out of the zinc waste. Heart of the process is the main reactor, where zinc oxide, ferrous sulphate and chlorine react to form ferric hydrate, zinc sulphate and zinc chloride.

First step is the preparation of zinc oxide from zinc waste—a conglomerate of metallic zinc, zinc oxide, zinc chloride, ammonium chloride and iron. This waste is crushed, the metallic zinc screened out, and all the combined zinc kilned to ZnO. For ease of distribution and charging to the reactors the ZnO is slurried; to avoid unnecessary evaporation it is slurried not in plain water but in a zinc salt solution taken from the hold tank just ahead of the evaporators. With this, zinc oxide is ready for the main reactor.

The second raw material, pickle liquor, must be cleaned before its ferrous sulphate content (about 21 percent) can be utilized in the main reactor; its life in the pickling tanks left it full of suspended solids and black as ink. Therefore it goes first to one of two preliminary reactors where a small proportion of the zinc oxide slurry is added to raise and control pH. Agitation sucks in air enough to oxidize a little ferrous iron to ferric and produce a ferric hydrate floc. The floc collects the dirt and when filtered out leaves a clean solution of ferrous sulphate. This is the solution that goes to the main reactor.

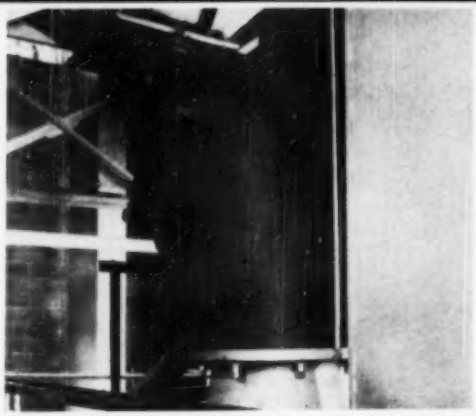
The main reactor operates batchwise. Some 1,500 gal. of ferrous sulphate solution are run in and heated to 220 deg. F. Then zinc oxide slurry and chlorine gas are added simultaneously; chlorine's function is that of oxidizing agent to convert ferrous iron to ferric. After 3 hr. all iron has been converted to ferric and precipitated as ferric hydrate; in solution are zinc sulphate and zinc chloride. Now to separate these three products.

First the ferric hydrate is filtered out and washed on a string-discharge, rotary vacuum filter; then it is ground, flash dried and stored for packaging. The flowsheet shows a little of the dried hydrate being added to the wet material coming off the filter discharge belt; that's done only because the just-filtered hydrate is a little too wet to work well in the mill. (Thus, Product No. 1)

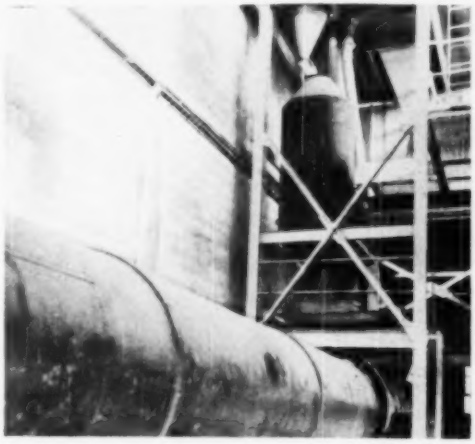
Filtrate from the string filter contains 2.4 lb. of zinc sulphate and 1 lb. of zinc chloride per gallon of solution. This is polished to sparkling water-whiteness by a leaf filter and stored for the vacuum evaporator-crystallizer unit. The first effect of the first evaporator takes out about 3 lb. of water per gallon of solution; the second effect crystallizes out almost all the zinc sulphate. An Oliver horizontal filter removes and washes the zinc sulphate crystals and delivers them to a rotary dryer, which discharges to storage and packaging. (Product No. 2)

Filtrate from the horizontal filter contains all the zinc chloride and a percent or two of zinc sulphate. The second, or finishing, evaporator crystallizes this remaining zinc sulphate and unavoidably takes a little zinc chloride with it. These mixed crystals, zincs sulphate and chloride, are removed on a second horizontal filter and recycled. The filtrate is the last of the salable products, a 70 percent solution of zinc chloride; it is stored for shipment in drums or tank cars. (Product No. 3)

Materials of construction in the wet processing steps are mostly glass-lined or Monel. The three reactors and some of the hold tanks are glass-lined; all the rest of the equipment is Monel—except for Teflon gaskets and packing, some Worthite pumps, and some glass and Hastelloy-C auxiliaries on the main reactor. Special and extreme precaution is taken with the main reactor to prevent the escape of hot, wet chlorine, either into the room or the rest of the system. Each of the three reactors is agitated and jacketed for steam; and each, incidentally, is the largest standard size (2,000 gal.) of its type.



**1** GYRATORY CRUSHER. Here zinc waste is crushed; any metallic Zn is only flattened; screening removes it.

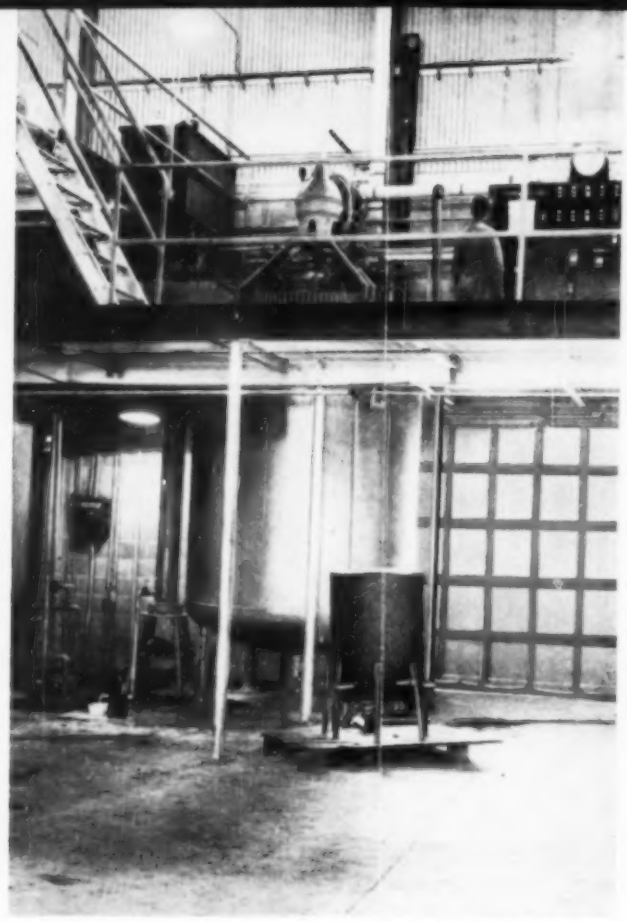


**2** KILN converts all combined zinc to ZnO. Beyond it is surge bin from which ZnO is fed to wet processing.

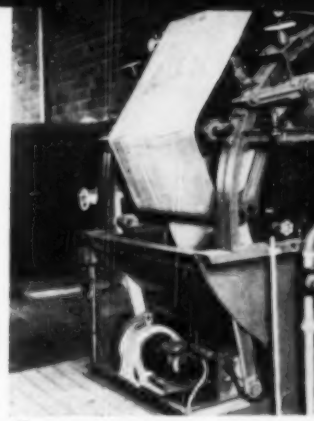
CHEMICAL ENGINEERING
*March 1949*
PAGES 144-147



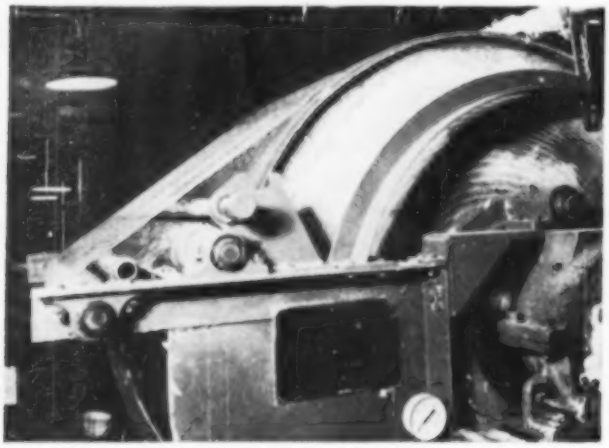
**3** PURIFICATION REACTORS. Little of pickle liquor's ferrous sulphate is oxidized by indrawn air to dirt-snaring ferric hydrate floc.



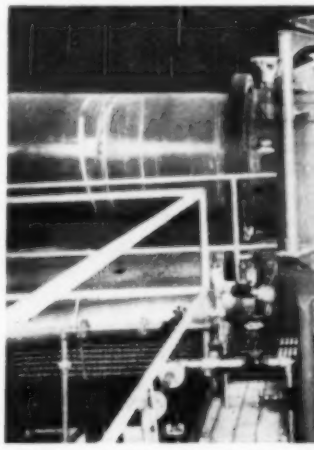
**5** MAIN REACTOR, like other two, is glass-lined, agitated, jacketed and has 2,000 gal. capacity. Flowsheet shows reactants and products.



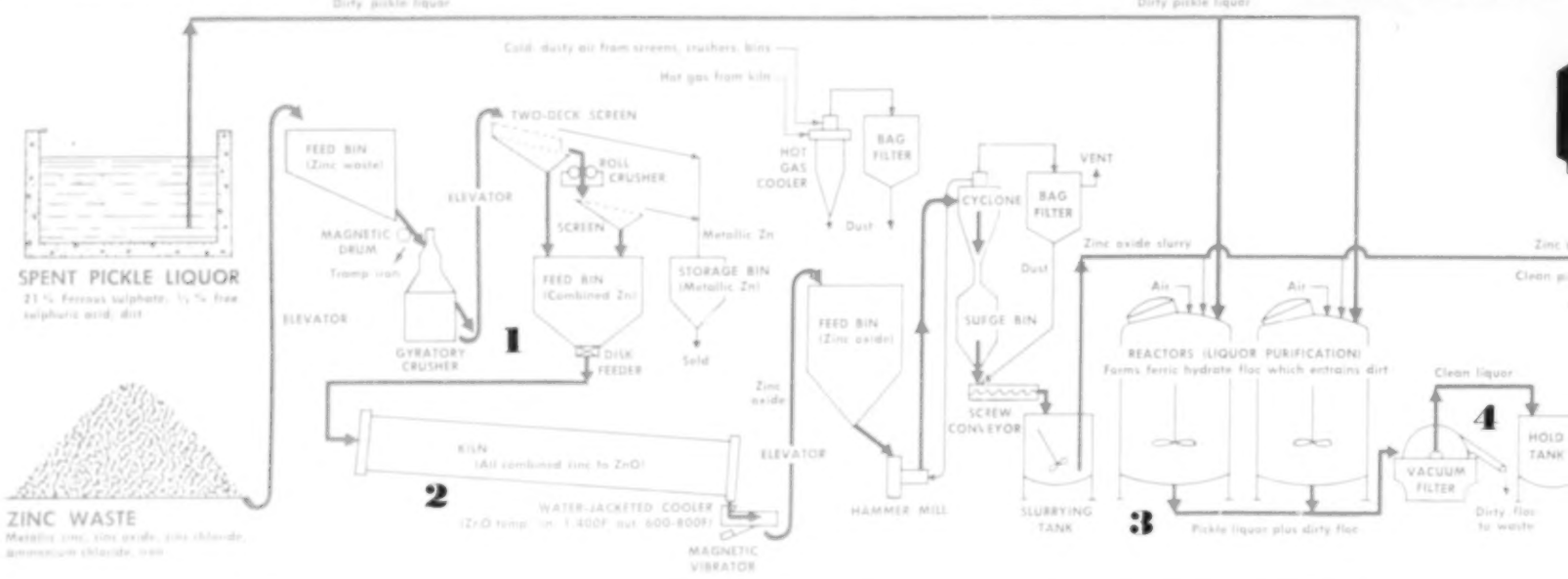
**6** SECOND FILTER receives slurry f hydrate precipitate to belt conveyor

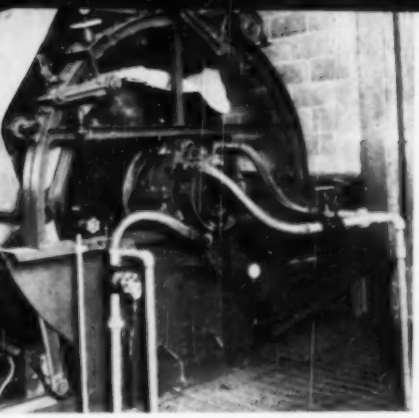


**1** FIRST FILTER removes dirty floc produced in reactors above. It, and the one in Photo 6, are rotary vacuum type, string discharged.

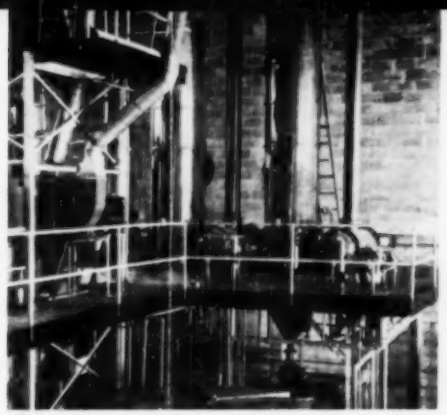


**7** POLISHING FILTER is leaf type and chloride, filtrate from filter

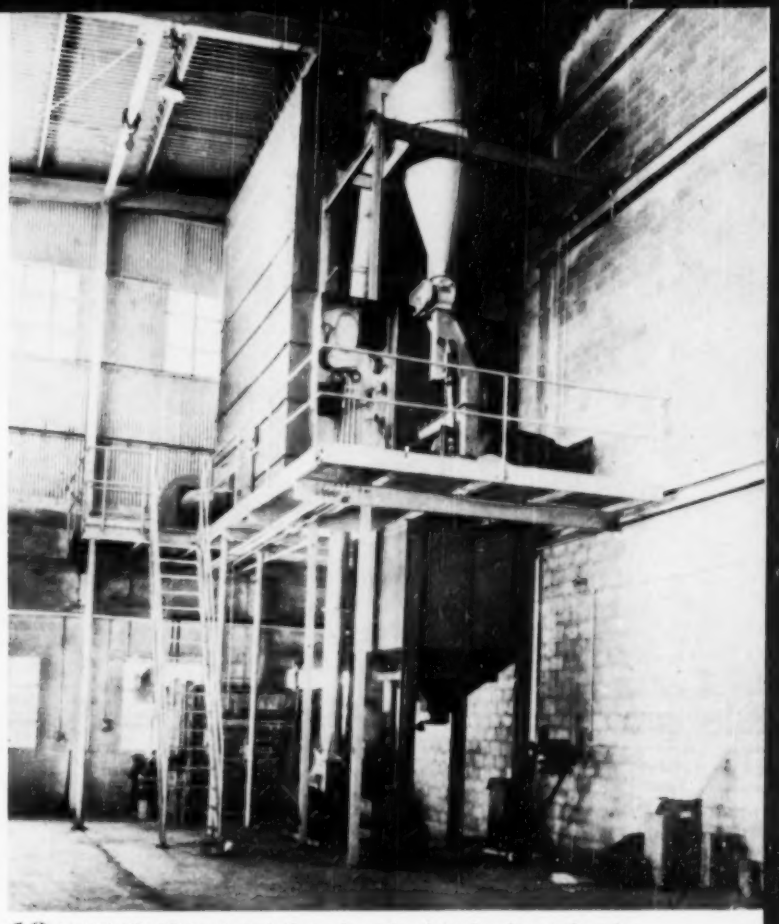


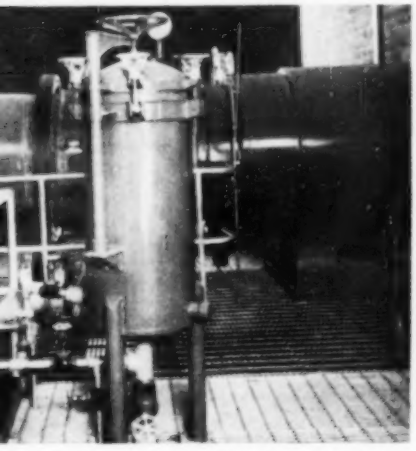


receives slurry from main reactor, discharges ferric to belt conveyor (emerges above platform, Photo 10).

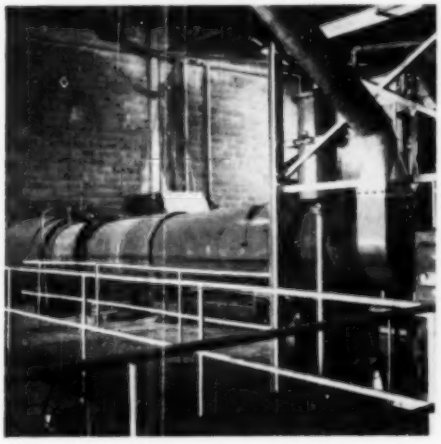


**8** EVAPORATOR-CRYSTALLIZER3 separate ZnCl from $ZnSO_4$ by fractional crystallization.





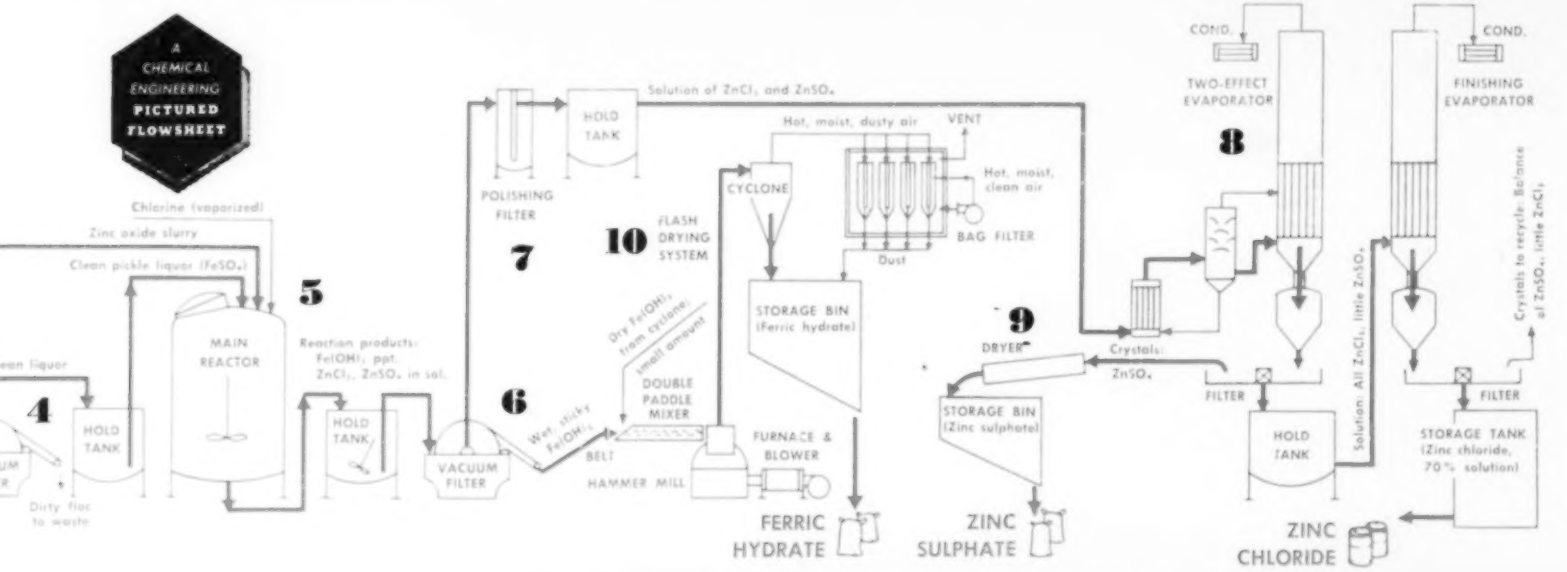
ER is leaf type. Here solution of zinc sulphate ate from filter above, is polished water-white.



**9** ROTARY DRYER handles zinc sulphate crystals. Zinc chloride stays in solution, is sold in drums.

**10** FLASH DRYER for ferric hydrate. Large box behind cyclone incloses bag filters; box stops condensation inside filters by holding warm air around them.

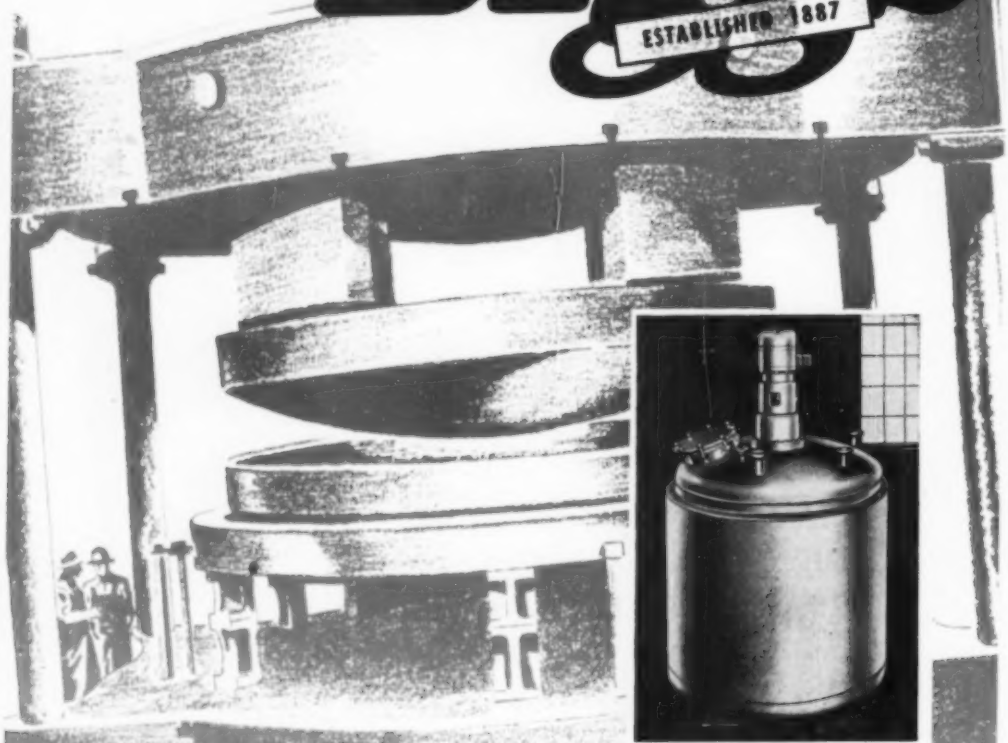
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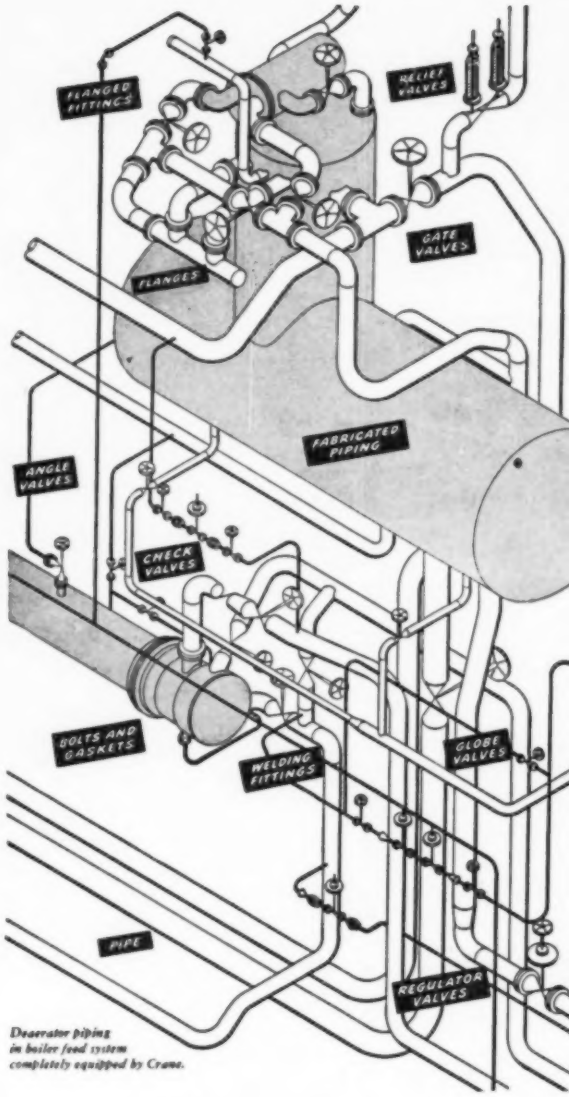
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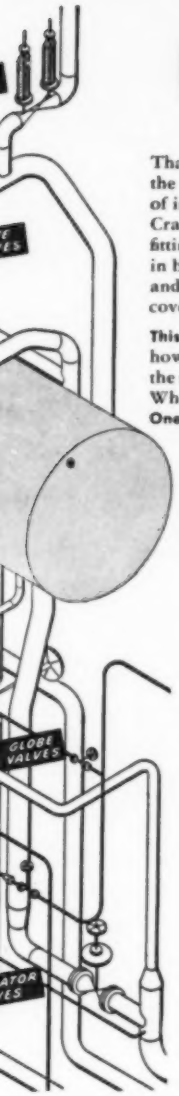

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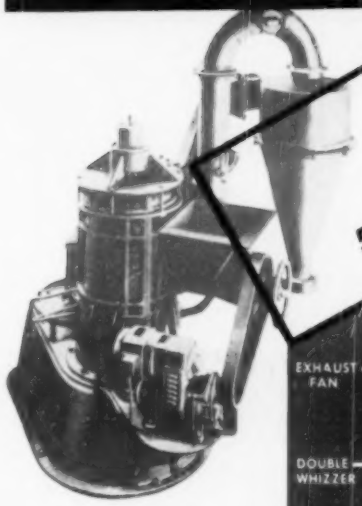
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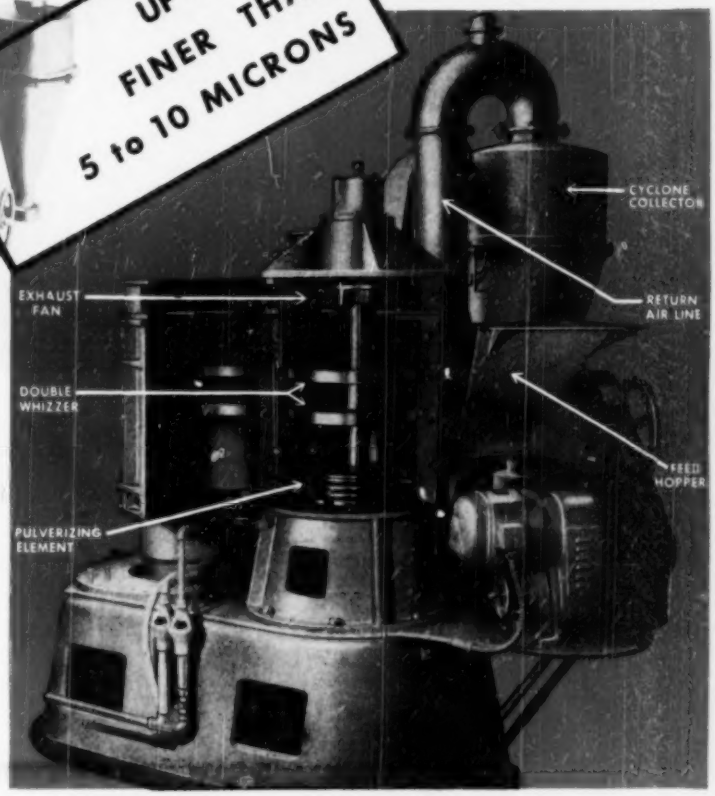




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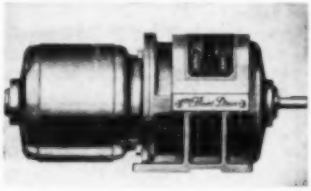
# PROCESS EQUIPMENT NEWS

*Theodore R. Olive,* ASSOCIATE EDITOR

## 1. Mechanical Rectifier

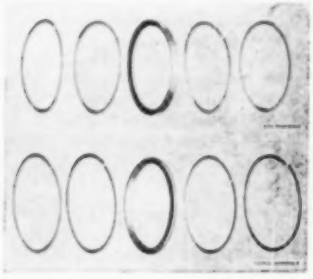
CONVERSION efficiencies of 96 percent or better are claimed for a new line of mechanical rectifiers for low-voltage power conversion offered by the I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa. This machine, based on the Siemens-Schuckert contact converter which made its appearance in Germany in 1940, is said to be particularly suitable for electrochemical uses where large d.c. currents are required at relatively low voltage. Several large installations were in use in Germany by the end of the war, including a large I.G. Farben plant at Hydebrecht. Improvements on the German design have resulted in a unit claimed to be light in weight and small in space requirements compared with other types of rectifying equipment, and with considerably higher efficiency.

At 600 volts the efficiency is only slightly better than that of the mercury arc rectifier, but at lower voltages which are generally preferred in electrolytic plants for safety, the efficiency is very much better. Basically, the device is a mechanical switch which produces d.c. from an a.c. supply by making metallic contact between a proper phase of an a.c. system and the associated d.c. system during the time interval the particular phase of the a.c. system is capable of delivering energy in the desired direction, and by breaking the metallic contact when the a.c. phase reverses its potential in relation to the d.c. voltage. This operation is performed sequentially and repeatedly in synchronism with the a.c. frequency.



## 2. Electric Hydraulic Drive

SIZES from 1 to 20 hp. are to be produced in a new line of electric powered fluid drive units made by the American Blower Corp., Detroit 32, Mich. Sizes above 7½ hp. will be produced later in the year. Smaller sizes are made now. The unit consists of a Gyrol fluid drive with a direct-connected motor, the assembly having standard NEMA mounting bolt hole dimensions. These units make the benefits of lowest starting current, smooth acceleration, overload protection and shock absorption available to users of many types of equipment such as centrifugals, conveyors and mixers. Since the motor starts unloaded and comes up to 85 percent of full speed before starting the load, acceleration is positive but gradual and a saving of as much as 50 percent in starting current is usually achieved.



## 3. Non-Extruding Packing

INTENDED primarily for hydraulic service at pressures up to 10,000 psi., a new non-extruding ring packing has been introduced by Greene, Tweed & Co., North Wales, Pa. The new packing is suitable for all systems except those employing continuous rotary motion. Known as G-T ring packing, it consists of a resilient sealing ring of synthetic rubber in a T-section, backed up or supported on each side by two non-extrusion ring retainers or guards. These rings are split and made of laminated phenolic material. After installation, the synthetic rubber member is under slight compression to provide a static seal. When operating pressure increases, the flange of the G-T ring expands radially against the non-extrusion rings, thus holding them in contact with the surface of the

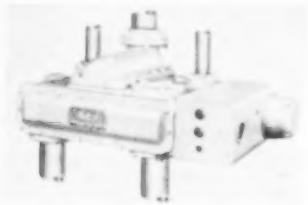
## CONTENTS


Mechanical Rectifier ..... 151
Electric Hydraulic Drive ..... 151
Non-Extruding Packing ..... 151
Multi-Port Valve ..... 152
Hydrostatic Scale ..... 152
Level Control Switch ..... 152
Shaft Seal ..... 152
Continuous Drainer ..... 152
Magnetic Starters ..... 152
High-Temperature Heaters ..... 154
Pressure Transmitter ..... 154
Rubber Expansion Joint ..... 154
Spray Dryer ..... 154
Improved Manometer ..... 154
High-Lift Pallet Truck ..... 156
Air Dryer ..... 156
Vertical Pump Motor ..... 156
Concentration Controller ..... 156
Level Control Valve ..... 158
Retaining Door for Cars ..... 158
Gas Unit Heater ..... 160
Nylon Filter Cloths ..... 160
Low-Voltage Rectifier ..... 162
Charge Indicator ..... 162
Screw Conveyor ..... 162
Corrosion Inhibiting Plugs ..... 164
Electromagnet ..... 164
Sponge Rubber Mats ..... 164
Metal Recording Chart ..... 164



FOR MORE INFORMATION
See Reader Service
Coupon on pages 167-168

piston rod or cylinder. This prevents extrusion into the clearance space between the mating parts. These packings are suitable for temperatures from −70 to +250 deg. F. and are available in an external or piston type seal, and an internal or rod type seal.



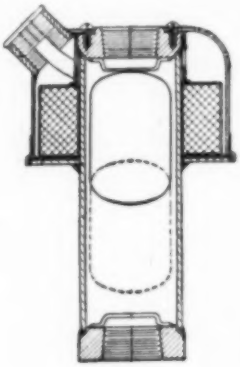
## 4. Multi-Port Valve

CLAIMED to be leak-proof, without rubbing surfaces and with only one stuffing box, a new multi-port valve is being offered by the Belco Industrial Equipment Division, Inc., 42 Iowa Ave., Paterson 3, N. J. The valve is employed in water-treating installations and can be used either for remodeling old softeners and filters, or for new installations. The valve has interchangeable seats and disks which are readily replaced, if necessary. Since the water pressure is employed to help open its cam-operated poppet system, it is operated by means of a single 1/20-hp. motor. Low pressure loss and negligible maintenance are also claimed.



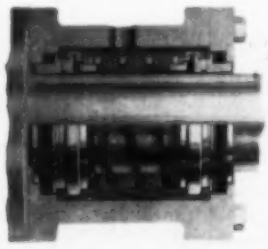
## 5. Hydrostatic Scale

A NEW scale, intended primarily for use on cranes and chain hoists, available in 2, 5 and 10 ton models, has been introduced by Hydroway Scales, Inc., 7632 Fenkell Ave., Detroit 21, Mich. The scale employs no springs or levers but uses a hydrostatic principle, permitting the construction to be virtually without moving parts and permanently sealed. Accuracy of the scale is said to be within ¼ of 1 percent.



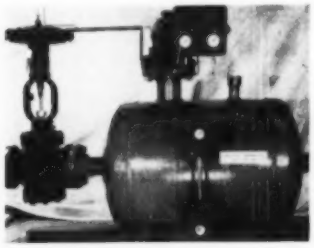
## 6. Level Control Switch

KNOWN as the Acrafloat, a new level control switch offered by the Clapp Instrument Co., Webster, Mass., employs a free float in a vertical metal pipe, position of which is detected by means of the magnetic field of a sensing coil. The coil in turn is connected into a relay circuit which controls the operation of a pump or valve, a signal light or any other indicating device. The instrument may be made in corrosion resisting materials of various sorts, for pressures as high as 20,000 psi. and temperatures up to 600 deg. F. It can be used both for level and for interface control.



## 7. Shaft Seal

KNOWN as Roto-Flex, a new rotating shaft seal for pumps, compressors, speed reducers and similar uses has been announced by the Gits Bros. Mfg. Co., 1846 Kilbourn Ave., Chicago 23, Ill. The seal is effective against either pressure or vacuum and is available in both single and double sealing units, the latter being shown in the accompanying illustration. These units are built to meet the requirements of the particular application, with construction materials of the lapped wearing surfaces and other component parts suitably chosen. A single unit is used for normal applications, while the double unit is used for installations where the liquid being sealed cannot act as a lubricant or coolant, and a separate liquid supply is admitted into the seal chamber.



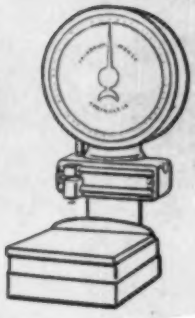
## 8. Continuous Drainer

INCREASING use in process industries is being found, it is claimed, for a new continuous drainer, developed by the Industrol Corp., 88-35 76th Ave., Brooklyn 27, N. Y. The device is most commonly used in removing steam condensate from shell and tube type exchangers. It consists of a vessel containing a level controller with a pilot system to operate the discharge valve. In a modification known as the dual-duty drainer, the functions of a pumping type trap and continuous drainer are incorporated into one unit. This device will automatically operate either as a pumping type trap or continuous drainer, as called for by the process.

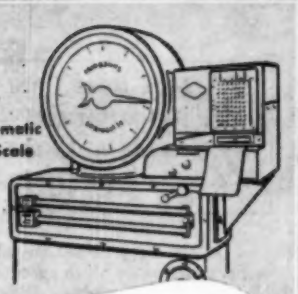


## 9. Magnetic Starters

A COMPLETE new line of a.c. magnetic starters for starting and protecting motors up to 50 hp. is being offered by the General Electric Co.'s



Bench Scale



Printomatic Dial Scale



Portable Dial Scale

# The easy WAY to WEIGH FAIRBANKS-MORSE Scales

Fast, accurate, easy-to-read, easy-to-handle Fairbanks-Morse Scales offer the easy way to "weigh." Because these lastingly accurate weighing instruments are designed for fast, dependable operation . . . for maximum ease of reading, they speed weighing operations . . . minimize the chance of costly human error.

There is a Fairbanks-Morse Scale for every weighing operation. Your Fairbanks-Morse weighing expert will be glad to assist you in selecting the right style and size for your operations. Fairbanks, Morse & Co., Chicago 5, Ill.

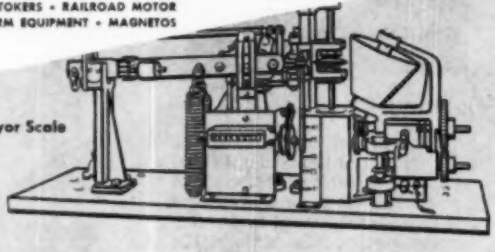


Weigh Can Scale

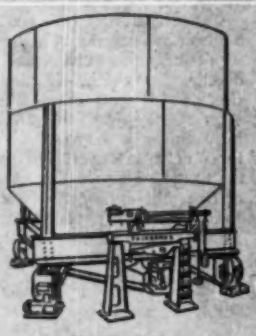
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MOTORS • GENERATORS • STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS



Belt Conveyor Scale



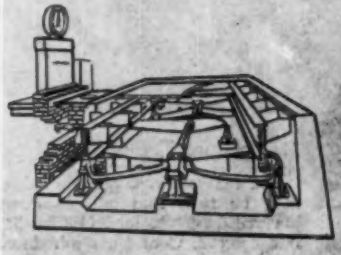
Hopper Scale




Full Capacity Beam



Counting Scale



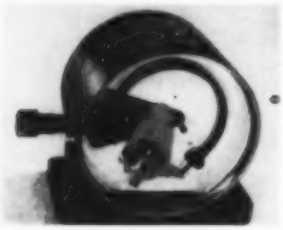
Truck Scale

Control Division, Schenectady, N. Y. These full-voltage starters, furnished in all NEMA sizes from 0 through 3, feature a one-piece plastic-incased coil inclosure which protects the windings against dirt, moisture or possible damage during installation. The silver contacts are easy to inspect, interchange and remove without special tools. An arc shield prevents arc-over between contacts. The starters are produced with general purpose, water-tight, dust-tight and hazardous-atmosphere type inclosures.



### 10. High-Temperature Heaters

CAPACITIES from 1 to 100 kw. are available in a new line of high-pressure, high-temperature immersion heaters developed by the Edwin L. Wiegand Co., 7514 Thomas Blvd., Pittsburgh 8, Pa. Various capacities are achieved by arranging groups of Chromolox tubular elements in extra heavy mounting flanges. Hair-pin shaped elements of triangular cross-section, are welded to forged steel flanges and arranged to permit the liquid to circulate freely. Various corrosion resisting sheath metals are available.

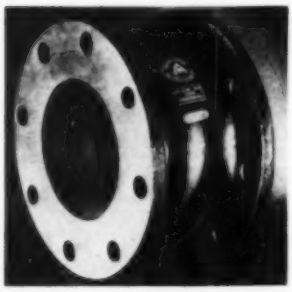


### 11. Pressure Transmitter

FOR TRANSMITTING pressure indications up to 50,000 psi., Manning, Maxwell & Moore, Inc., 11 Elias St., Bridgeport 2, Conn., has introduced

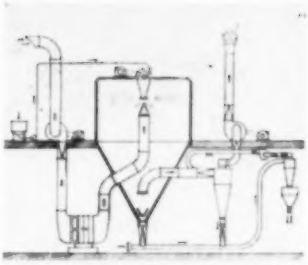
**FOR MORE INFORMATION**
See Reader Service Coupon on pages 167-168

the new Microsen pressure transmitter, an electronic device which operates on 115 volts at 50-60 cycles. Motion of the pressure-sensitive bourdon tube is picked up by means of the Microsen electromechanical relay and this motion is converted into a stable and accurate d.c. signal which can be indicated or recorded with standard electrical instruments. The electrical output is directly proportional to the movement of the bourdon tube, permitting use of uniformly graduated scales. Power consumption is only 2 watts and the combined resistance of the lead wire and indicator circuit may be any value up to 3,000 ohms without affecting performance of the transmitter.



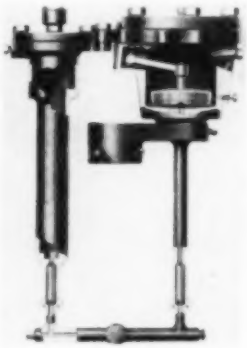
### 12. Rubber Expansion Joint

A NEW line of flexible rubber expansion joints for taking care of linear expansion, absorbing vibration and compensating for minor misalignment in piping is being offered by the Garlock Packing Co., Palmyra, N. Y. The joints are molded of rubber reinforced with cotton duck and steel wire or rings. A neoprene liner is supplied when oil resistance is necessary. Flexibility is secured by a central arch in the body of the joint, located midway between the flanges. Types are available for pressure, for vacuum, and for either pressure or vacuum. Joints may be used for handling hot or cold water, brine or exhaust steam at temperatures not over 180 deg. F., as well as for oils, acids or mild caustic solutions. Available pressure ratings range from full vacuum to 125 psi. Sizes range from 2 to 72 in.



### 13. Spray Dryer

WELL KNOWN in Denmark where it was developed, the Niro spray dryer is now being introduced into the United States by the Niro Corp., 52 Broadway, New York 17, N. Y. Dryers of this type have been in use for 20 years in various European countries. Their outstanding feature is a specially designed, high-speed rotary atomizing head which ejects the liquid as a mist into the drying chamber. Circulating hot air seizes the mist, instantaneously evaporating the water content. The dry product falls to the bottom of the chamber as a fine powder, where it is funnelled out as a finished, easily soluble product. It is claimed that the equipment is able to produce consistently uniform powders, at low temperatures, and with extremely high bulk densities when required.



### 14. Improved Manometer

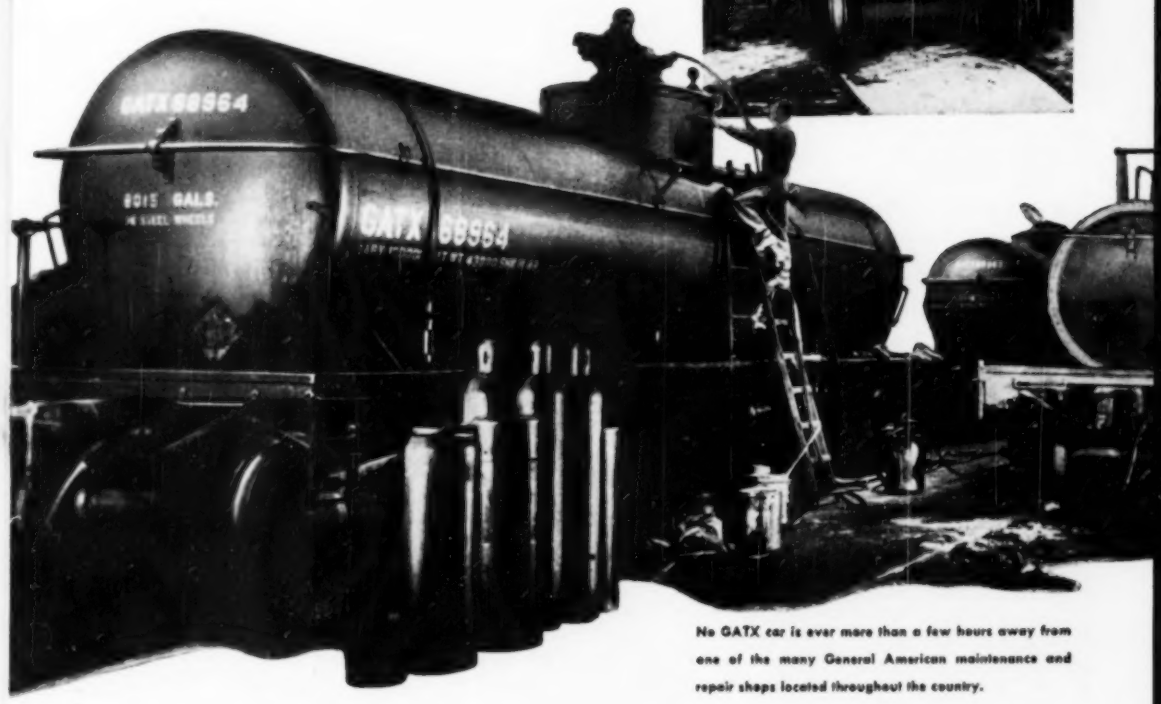
AVAILABLE for working pressures up to 1,500 psi., and differential ranges from 10 to 400 in. or more of water, a new mercury manometer now in production by Taylor Instrument Cos., Rochester 1, N. Y., is said to incorporate improvements resulting from a long period of intensive research, in close collaboration with industrial

## designer, builder, lessor of tank cars—

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Shipping economy starts in General American's own manufacturing plants. Here the GATX fleet is designed and built to transport all types of bulk liquids as safely, efficiently and economically as possible.




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# Sutton, Steele & Steele

## AIR TABLES

**are more sensitive concentrators than any other type of gravity separators**



**You cannot use wet tables or use flotation reagents on half-inch particles . . .**

**you CAN use AIR TABLES.**

**You cannot separate by wet tables or flotation reagents round from flat particles . . .**

**You CAN with AIR TABLES.**

**You can't treat 5 to 8 tons per hour on a single unit of wet table or flotation cell . . .**

**You CAN with an AIR TABLE.**

**You cannot size needle-like crystals with screens.**

**You CAN size such particles with an AIR TABLE.**

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**Our engineers will be glad to help solve your separating or concentrating problems and submit recommendations. Send sample for laboratory tests.**

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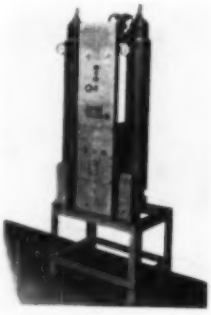
S S S PROCESS — THE PROCESS FOR BETTER PRODUCTS—FASTER


users. The manometer is suitable for measuring flow, liquid level and other pressure differentials and is claimed to give greater energy output through use of a large diameter float and long float travel. Teflon and stainless steel are employed in the leak-proof bearing. An improved damping device and readily interchangeable range chambers are other features. Straight-line calibration is an inherent feature of this manometer.




### 15. High-Lift Pallet Truck

BATTERY operation for both travel and lifting the load is incorporated in a new high-lift hand-guided electric pallet truck announced by the Yale & Towne Mfg. Co., Philadelphia Division, 4530 Tacony St., Philadelphia 24, Pa. The truck has a 2,500 lb. capacity and lifts pallets 66 in. for overhead tiering. The mast, 83 in. high, enables the truck to enter such low headroom spaces as street trucks and freight cars. The total weight of truck and battery is 1,965 lb., permitting the handling of loads in areas where heavier trucks cannot go.



### 16. Air Dryer

CAPACITIES from 15 to 750 scfm., at pressures from 30 to 150 psi. and inlet temperatures from 40 to 120 deg. F., are available in a new line of fully automatic compressed air dryers offered by the Anders Co., 420 Lexington Ave., New York 17, N. Y. These dryers produce a final exit dewpoint as low as minus 60 deg. F. All models can be furnished for either steam or electric operation. Owing to unique design of the steam and electric units, the dryers can readily be converted from steam to electric operation or vice versa. The manufacturer claims that these automatic units are produced at prices comparable with most manually controlled equipment now on the market.



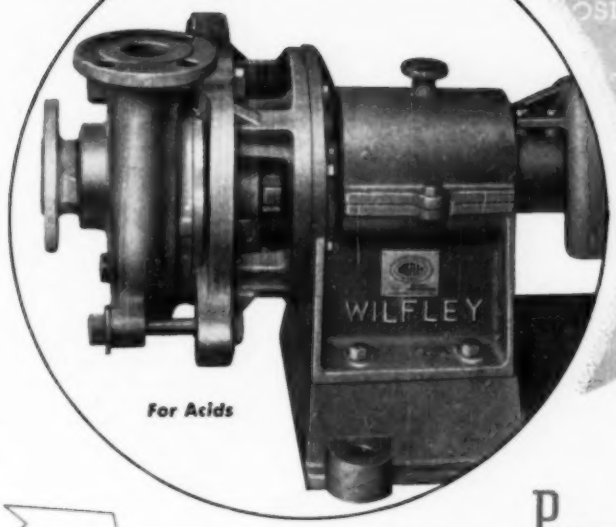
### 17. Vertical Pump Motor

ENCLOSED, weather-proof design, coupled with streamlined appearance, is incorporated in the new Verticlosed pump motor now being offered by U.S. Electrical Motors, Inc., 200 East Slauson Ave., Los Angeles 54, Calif., primarily for deep-well pumping service. An adjustable hollow shaft is used to permit precise adjustment of the impellers of the deep well turbine pump, a construction which also permits the heavy thrust bearing to be placed in the top of the motor and eliminates need for a flexible coupling. The motor uses down-draft ventilation and a weather-proof housing.

### 18. Concentration Controller

FOR APPLICATIONS where the concentration of a caustic or acid bath may vary considerably without much change in pH value, conductivity or other variables, the Milton Roy Co., Philadelphia 18, Pa., has developed an automatic titrating system which utilizes a duplex controlled volume pump. One pump continuously withdraws a sample of the material to be controlled, while the other continuously supplies a titrating chemical in fixed proportion to the first material. The two flows are mixed, giving a resulting

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...PLUS continuous, trouble-free operation make the WILFLEY Acid Pump a potent factor in reducing the cost of handling acids, corrosives, hot liquids or mild abrasives. This is the acid pump that delivers full production on a 24-hour basis without attention. 10- to 2,000-G.P.M. capacities; 15-to150-ft. heads and higher. Individual engineering on every application. Write or wire for specific information that will help reduce YOUR cost.

**A Companion to the Famous WILFLEY Sand Pump**

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# WILFLEY *Acid* PUMPS

Crimpy
The Buffalo Wire Cloth Man
Gets Tinned!

I PUT ON A COAT OF TIN
. . . right over my steel wire before I'm woven, to take on separating, sorting and cleaning jobs with flour, chemicals, powders, seeds and foods.

BRING ON THE FOOD! I'M NON-CONTAMINATING
My coating is pure tin . . . and smooth as silk. Oh, that's not all! I resist humidity . . .

BUT MY MIND ISN'T ALWAYS ON FOOD!
I'm fast . . . can take quite a bit of abrasion, as you can see!

PEOPLE FIND ME EASY TO WORK WITH!
Want to form me? Go ahead! Easy? You bet- unroll me and I'm always flat and straight- don't draw like other cloths.

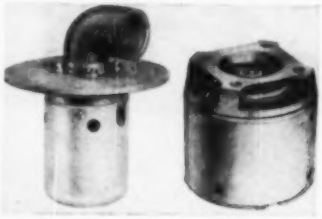
I'M ATTRACTIVE PRICE-WISE TOO!
I've the economy of steel with only the small difference for my tin coating. But it's that coating which improves separation by filling my pores!

"BUFFALO" TINNED WIRE CLOTH
Woven in a large range of square meshes; available in rolls or cut pieces; made into reel covers; furnished with hook strips or webbing.

Buffalo WIRE WORKS CO., INC.
Manufacturer of All Kinds of Wire Cloth Since 1869.

482 TERRACE BUFFALO 2, N. Y.


pH value on a steep portion of the curve, which thus indicates the strength of the controlled material. It is then possible with a pH controller to adjust the feed to the main tank so as to hold the desired strength.



### 19. Level Control Valve

For various applications where a compact light-weight unit is required, the Parker Appliance Co., Cleveland 12, Ohio, is offering a new float-actuated level control valve of high sensitivity and low pressure drop. These valves operate by bypassing a small amount of line flow to a pressure-balanced pilot valve, actuated by a small float. The pilot valve is said to operate independent of pressure and flow rates and so maintains uniform shut-off and re-opening levels in any liquid tank over a wide range of operating conditions. Valves are built in sizes for ¾ to 1 in. lines and 1¼ to 2 in. lines. The larger weighs only 1 lb.



### 20. Retaining Door for Cars

Much weight can be saved, it is claimed, through use of a new steel-strap-reinforced paper retaining door employed in box cars carrying bulk commodities such as industrial chemicals, alumina, lime, cement, etc. Manufactured by the Signode Steel Strapping Co., 2600 North Western Ave., Chicago 47, Ill., the door is available in heights of 3, 4 and 6 ft., with a standard width of 7 ft. 2 in. It con-



*It's New!*

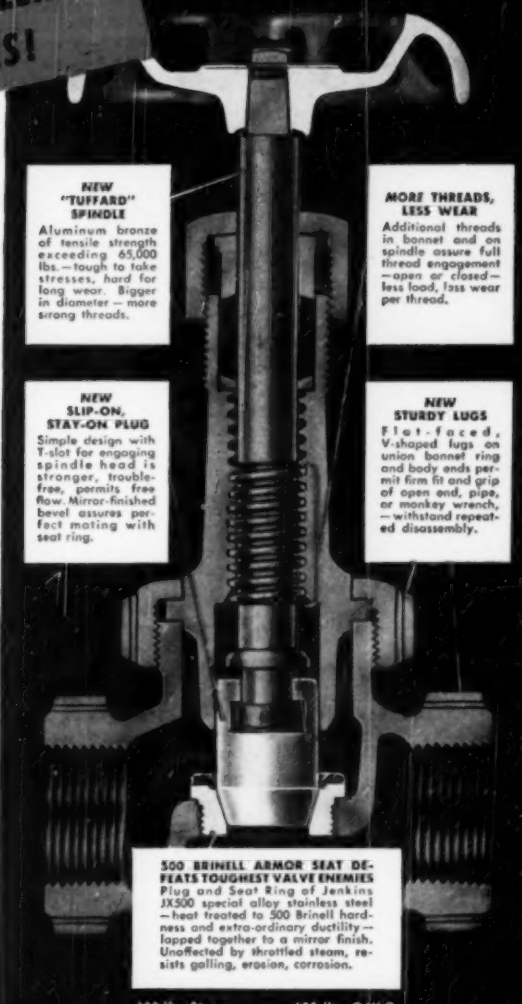
# JENKINS ANSWER TO VALVE-KILLING SERVICES!

## JENKINS Fig. 976-A

PLUG TYPE

*Armor Seat*

BRONZE GLOBE VALVE



**NEW "TUFFARD" SPINDLE**

Aluminum bronze of tensile strength exceeding 65,000 lbs.—tough to take stresses, hard for long wear. Bigger in diameter—more strong threads.

**MORE THREADS, LESS WEAR**

Additional threads in bonnet and on spindle assure full thread engagement—open or closed—less load, less wear per thread.

**NEW SLIP-ON, STAY-ON PLUG**

Simple design with T-slot for engaging spindle head is stronger, trouble-free, permits free flow. Mirror-finished bevel assures perfect mating with seat ring.

**NEW STURDY LUGS**

Flat-faced, V-shaped lugs on union bonnet ring and body ends permit firm fit and grip of open end, pipe, or monkey wrench,—withstand repeated disassembly.

**500 BRINELL ARMOR SEAT DEFEATS TOUGHEST VALVE ENEMIES**

Plug and Seat Ring of Jenkins JX500 special alloy stainless steel—heat treated to 500 Brinell hardness and extra-ordinary ductility—lapped together to a mirror finish. Unaffected by throttled steam, resists galling, erosion, corrosion.

300 lbs. Steam 600 lbs. O.W.G.

**BUILT TO BREAK RECORDS FOR LONG LIFE**

Now, for the most severe services, you can choose the new Jenkins Fig. 976-A with complete confidence that it will set new economy records. Use it for pressure regulation, bleeds, drips, and drains, or any close regulation of steam that threatens wire drawing. It will lower maintenance, last longer, where entrapped pipe chips, scale, or rust tubercles are a problem.



**SMASHED PIPE CHIPS, WIRE, LEAVE NO SCARS**

Steel pipe chips and 1/16" wire rod, with Brinell hardness in excess of 300, were crushed between the new Jenkins JX500 Plug and Seat Ring without leaving a scratch or dent. That's proof of super hardness!

Compare Fig. 976-A, part for part, and see why it's as nearly wear-proof, trouble-proof, and maintenance-free as any stock valve can be. Only a few of the dozen ways it's better are shown here. Get the complete story in the new folder. See why it's unrivalled for endurance and economy,—why it's your best buy in plug-type valves! Use coupon.

Jenkins Bros., 80 White St., New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.

LOOK FOR THIS DIAMOND MARK

MADE JENKINS MARK SINCE *Jenkins Bros.* 1864

# JENKINS VALVES

*Types, Sizes, Pressures, Metals for Every Need*




GET COMPLETE DETAILS—IN THIS NEW FOLDER

*Mail Coupon Today!*

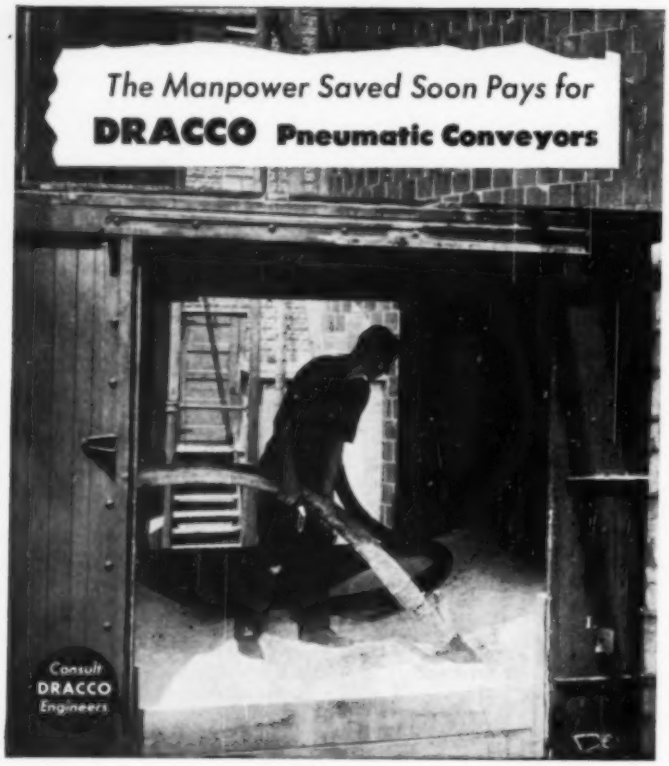
JENKINS BROS., 80 WHITE ST., NEW YORK 13

*Please send Armor Seat Valve folder—Form 193*

Name _____

Company _____

Address _____




DRACCO Pneumatic Conveyors save money in MANY ways — perhaps the most important is in MANPOWER. In most installations the saving in labor goes a long way to pay for the entire job. If you handle chemicals, grains, or granular materials, find out what DRACCO Pneumatic Conveyors will save. Many plants are still using obsolete handling methods not realizing the many ways DRACCO Pneumatic Conveyors reduce handling costs. DRACCO Engineers have over 30 years experience reducing handling costs to the MINIMUM, why not consult them?

For Further Information Write

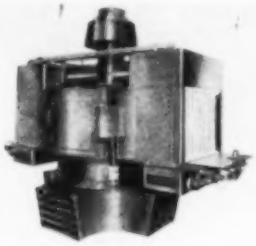
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DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION


FOR MORE INFORMATION
See Reader Service Coupon on pages 167-168

sists of several thicknesses of heavy duty, water-repellent kraft liner board, hot laminated with an asphaltum binder and reinforced with ¾ x 0.02 in. steel straps. The device has been extensively tested and has been approved by the AAR. It is easily applied by two men, application consisting in nailing the reinforcing strips at either side of the door. A dust-tight flap at the bottom is nailed down, and a wooden strip is applied at the top for extra reinforcement.



### 21. Gas Unit Heater

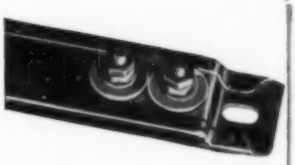
SIMILAR in principle to the steam-heated revolving unit heaters made by this company, a new gas-fired heater which employs either natural or manufactured gas is being offered by the I.. J. Wing Mfg. Co., 154 West 14th St., New York, N. Y. The heater combines gas burners, heat exchanger and combustion chamber with a motor-driven fan and revolving discharge outlet. The device is designed for overhead location, projecting the heated air to the working level in all directions. In the summer the gas can be turned off and the fans used to produce circulation.

### 22. Nylon Filter Cloths

AFTER several years of research which included formulation and testing of many different weaves, Filtration Engineers, Inc., 155 Oraton St., Newark 4, N. J., has announced a line of nylon filter fabrics, together with facilities for tailoring and fitting such cloths to any make of rotary vacuum filter, filter press or pressure filter. The new cloths, highly resistant to acids, alkalis, and bacterial action, are said in severe cases to last many times as long as cotton fabrics. Since they are

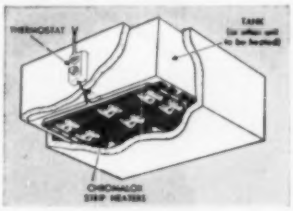
# CHROMALOX offers you efficient and economical *Packaged Electric Heat*—to fit your specific needs

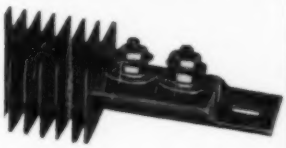
CHROMALOX Electric Heaters give dependable "on-the-spot" heat where and when heat is needed. They produce uniform and accurate temperatures with automatic or manual control. *Low initial cost, low installation cost and low operating costs are among the other advantages they give you.*



## CHROMALOX STRIP HEATERS

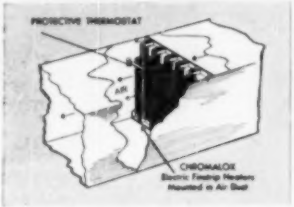
Easy-to-install CHROMALOX Strip Heaters are clamped to flat or curved surfaces, round vats, pipes and tubes. They are made in straight lengths, rings and segments . . . and may be curved or bent to fit cylindrical or "dished" surfaces. Typical applications include: armatures, cleaning tanks, molds, process kettles, plating baths, revolving rolls, etc.

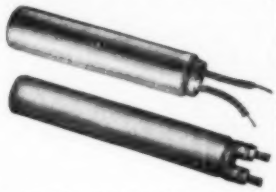


## CHROMALOX FINSTRIP HEATERS

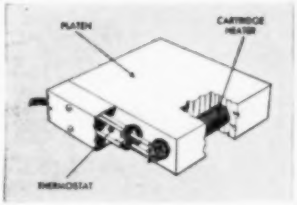
Finstrip Heaters are used for drying, curing, space heating and other applications requiring heated air under forced circulation. Air and gases are quickly and easily heated; uniform operating temperatures up to 750° F. are accurately maintained by thermostatic control. Finstrips, designed for minimum turbulence, are well suited for use in air-ducts.



## CHROMALOX CARTRIDGE HEATERS

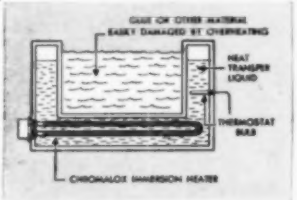
Compact CHROMALOX Cartridge Heaters are ideal for use when concentrated heat is needed. Inserted into close-fitting holes, they provide easily controlled heat for dies, molds, platens, etc. They are quickly and easily installed in stationary or moving parts with minimum labor and material costs; they may be controlled for accurate, dependable, care-free operation.






## CHROMALOX IMMERSION HEATERS

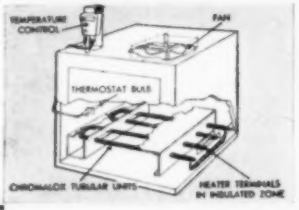
CHROMALOX Immersion Heaters are used in degreasing, cleaning, pickling and plating baths; for melting greases, asphalts and similar viscous fluids; for heating Dowtherm, Arochlor, Prestone, and other heat-transfer mediums. Available in many sizes and types, with alloy sheaths to resist corrosive action.






## CHROMALOX TUBULAR HEATERS

These heaters, in straight or tailored shapes are used for convection, conduction and radiant heating. They may be clamped to metal surfaces, used in ovens, or immersed in greases. They are especially useful to heat ovens, calenders, molding-presses and similar equipment utilizing heat.



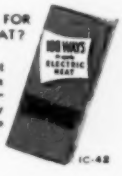

# CHROMALOX

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IC-42

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**Activated Bauxite**

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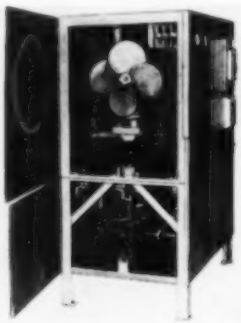
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better able to stand abrasion and mechanical abuse, lighter cloth can often be selected. The combination of synthetic yarn and proper weave is said to give the best possible combination of filtering qualities, easy cleaning, maximum life and minimum blinding.



### 23. Low-Voltage Rectifier

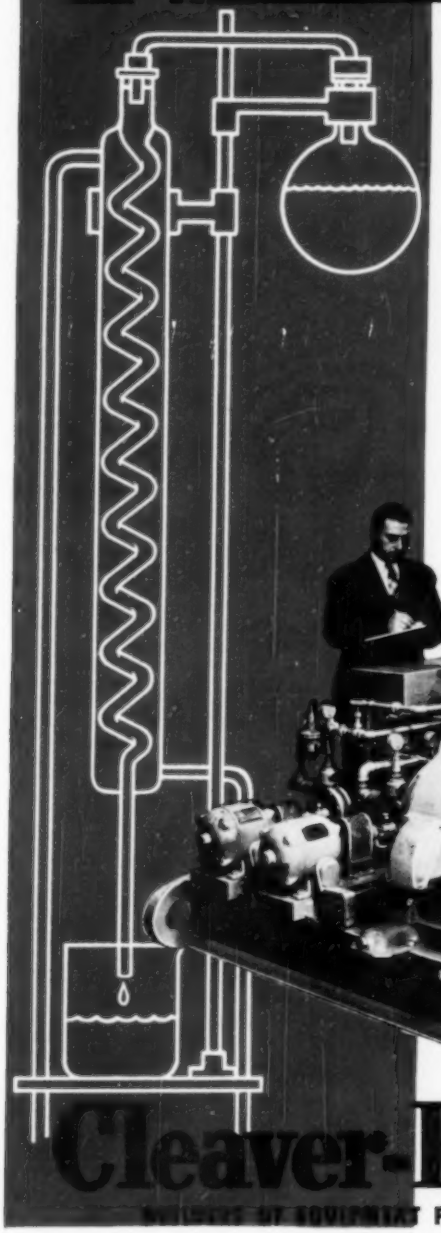
FOR PROVIDING direct current for such operations as electroplating and cleaning, and electrolytic production of aluminum hydroxide for water purification, the Electronic Rectifier Co., Rochester 2, N. Y., has introduced its new type N2400CX low-voltage, high-amperage selenium type rectifier. The device, which occupies a space of 31x48x71 in. and weighs 2,100 lb., is claimed to have an exceptional amount of rectifier plate area, namely 4.05 sq.in. per amp. The rectifier operates on an input of 440 volt, 3-phase alternating current, with an output continuously variable from 0 to 6 volts d.c., and an output amperage of 2,400. Because the variable voltage transformer is motor-driven, the output voltage can be adjusted from remote locations or made to respond to automatic controls. The entire unit is self-contained in a welded steel cabinet.

### Equipment Briefs

**24.** A NEW charge indicator giving the momentary charge condition of the battery has been developed by Gould Storage Battery Corp., Trenton, N. J. Intended for mounting on the dashboard of electric industrial trucks, the device informs the operator of the battery's condition at all times and thus increases battery life by preventing operation in an over-discharged condition.

**25.** TO PERMIT complete discharging of screw conveyors, particularly in installations where sanitation is needed, the Screw Conveyor Corp., Hammond, Ind., has developed the Screw-Flo con-

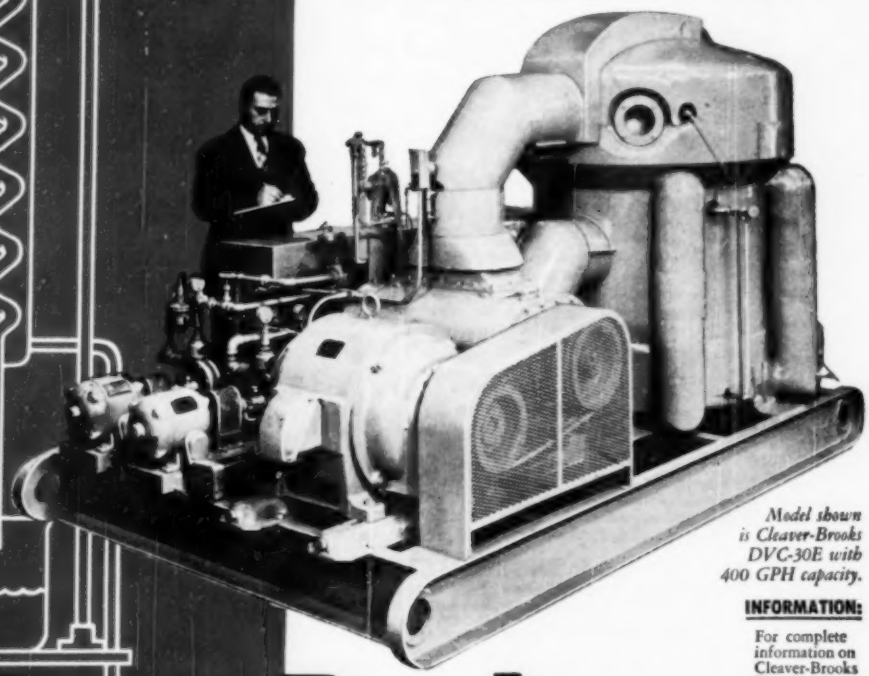
# NEED PURE DISTILLED WATER -IN QUANTITY-AT LOW COST?



## *Pure distilled water with power consumption as low as 65 KWH per 1000 gallons.*

CLEAVER-BROOKS Compression Distillation Units give you volume quantities of chemically pure (pyrogen free) distilled water suitable for intravenous or medical preparations, pharmaceuticals or chemicals. There's a model to fit your need — standard sizes 75 to 2100 gallons per hour. Larger sizes to fit your specific applications. Fully automatic in operation. Factory tested. Shipped as complete distilling plants in the smaller sizes and ready for field erection in larger plants.

CLEAVER-BROOKS COMPANY
339 East Keefe Avenue, Milwaukee 12, Wisconsin.



*Model shown is Cleaver-Brooks DVC-30E with 400 GPH capacity.*

**INFORMATION:**

For complete information on Cleaver-Brooks Distillation Units, write on your letterhead to Dept. CDU.

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MANUFACTURERS OF EQUIPMENT FOR GENERATION AND UTILIZATION OF HEAT

# for QUICK, ACCURATE MEASUREMENTS

Here are four instruments widely used by industry for a large variety of measuring needs . . . highly valued for their accuracy, dependability, and convenience . . . backed by Meriam's 37 years' specialization in the field of measurement.



**U-Type Absolute Pressure Gauge**

For the measurement of *absolute pressures* from one millimeter of mercury to the equivalent atmospheric pressure. Of simple design—accurate and dependable. Gauge head fastens to body by a single wing nut. Available in wall or flush front mounting styles. Ask for catalog sheet C-1142 WM.



**Clean-Out U-Type Manometer**
(Model B-1169 WM)

Semi-steel clean-out head is removable from body frame for filling and cleaning U-tube. For line pressures up to 100 lbs. per sq. in. Large bore "pyrex" tubing ⅜" inside diameter gives flat indicating fluid meniscus. Bold ½" high scale numerals provide for distant reading. Ask for catalog sheet B-1169 WM.



**Well Type Manometer**
(Table Mounting)

For portable service in the field, production testing, or in the laboratory. Glass tubing is gland packed at each end block and is supported at spaced intervals to prevent tube distortion. Also available for wall mounting, pipe mounting, and flush front panel mounting. Ask for catalog sheet A-203 TM.



**Well Type Manometer**
(Front-of-Board Mounting)

The instrument body channel, scale, and indicating tube mount to the front of the panel; instrument well mounts behind panel. Connections are made behind the mounting panel. Provides an accurate, quick, and direct method of measurement. Ask for catalog sheet A-324 FB.

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MANOMETERS, METERS AND GAUGES FOR THE ACCURATE MEASUREMENT OF PRESSURES, VACUUMS AND FLOWS OF LIQUIDS AND GASES


veyor in which a slowly revolving tube replaces the usual trough, while the screw itself travels at its customary speed. It is claimed that the new design completely discharges material, which is said to be impossible with the old U-type trough.

26. To PROTECT heat exchangers, piping and other hydraulic equipment against corrosion, Rotometals, Inc., 980 Harrison St., San Francisco 7, Calif., is offering a line of screw-in zinc plugs for corrosion inhibiting. The zinc rods, produced in sizes from ⅛ to 1 in. and in lengths up to 12 in., are provided with standard pipe plug ends which screw into the equipment to be protected. Known as Cor-In, these rods may readily be renewed by merely unscrewing the used-up material and screwing in a new one.

27. To PERMIT removing tramp iron from exceptionally heavy burdens of material carried on belt conveyors, or passing down chutes, the Dings Magnetic Separator Co., 4740 West McGeogh Ave., Milwaukee, Wis., has developed a so-called deep-burden electromagnet. This magnet operates suspended over the flow of material and is suitable for heavy burdens and exceptionally fast belt speeds. In one installation it removes tramp iron from coal on a 42-in. belt which is 2,449 ft. long and delivers 1,000 tons per hour. It was impossible to place it closer than 18 in. to the belt.

28. SPONGE rubber, in a thickness of ¼ in., is being produced in a line of standard industrial mats in a variety of sizes, in several colors and with beveled edges, by the Atlas Sponge Rubber Co., 806 East 61st St., Los Angeles 1, Calif. These mats are claimed to be effective in increasing production by preventing foot and leg strain of employees who stand on concrete or tile floors.

29. FOR USE in certain kinds of recording instruments operating under extremes of pressure, temperature or other adverse physical conditions, the Otis Engineering Corp., Dallas, Tex., has developed a new type of coated metal recording chart which will not shrink, expand, deteriorate or become deformed under contact with moisture, hydrocarbons or corrosive elements. The coated surface is extremely sensitive, it is claimed, to very light stylus or dry pen pressure. Developed originally for use in instruments for calipering oil well tubing under pressure, the charts are suggested also for other special instruments in which it may be advantageous to admit fluids, pressure or atmosphere into the working parts of the recording device.




# JUST THE SAME!

**THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED BEATS TOUGH CORROSION CONDITION**

This 554-foot chimney was built* in 1936 for International Nickel of Canada to handle gases from copper reverberatories and converters. Now, after 13 tough years, the smoke goes up this chimney just the same as the day the stack was built!

## 13 YEARS WITHOUT REPAIR

The gases contain $SO_2$ with moisture content slightly above atmospheric humidity. Despite this corrosive condition, up to the present time no repairs have been made to this stack, and no evidence of deterioration has been noticed.

## HERE'S WHY:

The entire lining of this stack was built with acid-proof brick laid in Penchlor Acid-Proof Cement.** In addition the top fifty feet of this stack was further protected by using Penchlor Acid-Proof Cement for pointing the outside surface joints. Penchlor Acid-Proof Cement is a superior sodium silicate cement that is quick-setting and self-hardening. Its outstanding record of satisfactory service has been proved in chemical plants, steel mills, paper and pulp mills, oil refineries and smelting plants.

## SEND FOR CASE REPORT

If you have a corrosion problem, you'll be interested in further details about this Penchlor installation, as well as an illustrated brochure on Penchlor. Write for Penchlor Booklet No. 6.

Special Chemicals Division

**PENNSYLVANIA SALT MANUFACTURING COMPANY**

1000 Widener Building, Philadelphia 7, Pa.

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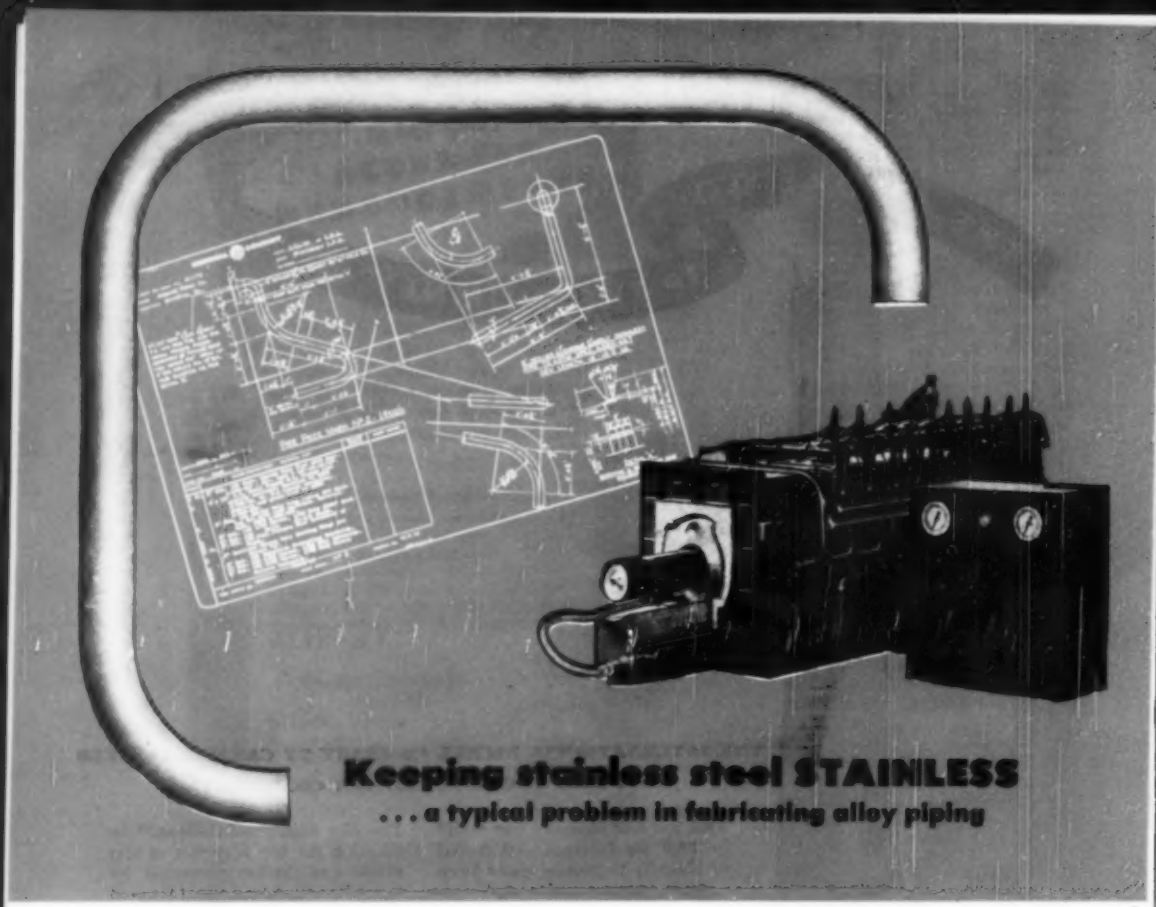
PENN SALT

**CHEMICALS**

**99 Years' Service to Industry**

*Built by Custodis Canadian Chimney Company, Limited, Montreal

**Penchlor Acid-Proof Cement was furnished by our Canadian Associates G. F. Sterne & Sons, Ltd., Brantford, Ontario



# Keeping stainless steel STAINLESS

## . . . a typical problem in fabricating alloy piping

Heat a piece of stainless steel pipe to bend it and right away you're up to your ears in metallurgical complications. To begin with, stainless steel isn't just one alloy. There are hundreds of different types of stainless steel, each selected for its resistance to corrosion or its stability at high temperatures. To maintain the metallurgical properties which dictate the choice of a particular alloy steel, you have to know the temperature range within which this steel may suffer excessive metallurgical changes. And you have to have specialized equipment to maintain the precise control necessary to avoid these hazards.

Grinnell pipe fabrication equipment includes specially designed gas-fired radiant heat furnaces for this precisely controlled heat treatment of stainless steels and other alloy steels. Multiple burners are strategically located to distribute temperature uniformly and to prevent harmful flame impingement. Precision instruments regulate temperature and time.

It's an intricate business . . . fabricating alloy steel piping. It's a job for Grinnell prefabricating plants because Grinnell has the equipment and modern methods, the interpretive engineering, the metallurgical research facilities and the skilled personnel.

99 YEARS PIPING

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## PROCESS EQUIPMENT NEWS

*See pages 151-164*


Mechanical Rectifier ..... 151
Electric Hydraulic Drive ..... 151
Non-Extruding Packing ..... 151
Multi-Port Valve ..... 152
Hydrostatic Scale ..... 152
Level Control Switch ..... 152
Shaft Seal ..... 152
Continuous Drainer ..... 152
Magnetic Starters ..... 152
High Temperature Heaters ..... 154
Pressure Transmitter ..... 154
Rubber Expansion Joint ..... 154
Spray Dryer ..... 154
Improved Manometer ..... 154
High-Lift Pallet Truck ..... 156
Air Dryer ..... 156
Vertical Pump Motor ..... 156
Concentration Controller ..... 156
Level Control Valve ..... 158
Car Retaining Door ..... 158
Gas Unit Heater ..... 160
Nylon Filter Cloths ..... 160
Low Voltage Rectifier ..... 162
Charge Indicator ..... 162
Screw Conveyor ..... 162
Corrosion Inhibiting Plugs ..... 164
Electromagnet ..... 164
Sponge Rubber Mats ..... 164
Metal Recording Chart ..... 164


## NEW PRODUCTS & MATERIALS

*See pages 171-184*


Phthalate Plasticizers ..... 171
Amino Acid Antagonist ..... 171
Neutron Sources ..... 171
Xylene Hexafluoride ..... 171
Plasticizers for Vinyls ..... 171
Glyceryl Mono Oleate ..... 172
Corrosion-Resistant Coating ..... 172
Synthetic Detergent ..... 174
Skin Astringent ..... 176
Refrigeration Oil ..... 176
Phenolic Molding Powders ..... 176
Surface-Active Agent ..... 178
Mold Lubricant ..... 178
Caprylic and Capric Acids ..... 180
Vapor Phase Inhibitor ..... 182
Sodium Chlorite Stripper ..... 184
Hexadecene ..... 184


## MANUFACTURERS' PUBLICATIONS

*See also pages 340-346*

**101. Filter Presses.** T. Shriver & Co., Harrison, N. J.—24-page Catalog No. 49 describes the line of filter presses manufactured by this company. The catalog lists the design features of these filter presses, data on capacity, types of frames, methods of operation, and materials of construction. Cost curves, up

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to date as of October 1948, are given for preliminary economic evaluations and as a guide to choice of the proper filter press size. A horizontal, plate-type filter is also described.

**102. Hydrofluoric Acid.** Harshaw Chemical Co., Cleveland, Ohio—36-page booklet gives complete data on the physical properties and handling of anhydrous hydrofluoric acid. Included also are sections on materials of construction and types of construction to be used in handling this acid. The bulletin also describes the use of this acid as a condensing agent, as a fluorinating agent, and in the alkylation of isoparaffins with olefins.

**103. Mixers.** P. O. Abbe, Inc., Little Falls, N. J.—32-page Catalog V describes the various types of mixers and mills produced by this company and gives representative data on sizes and capacities. Included are mass and paste mixers, spiral blade mixers, double cone blenders, vertical and horizontal mixing mills, and ball and pebble mills.

**104. Corrosion-Resistant Equipment.** Fansteel Metallurgical Corp., North Chicago, Ill.—20-page booklet describes the various types of equipment produced by this company. The majority of this equipment is manufactured of special alloys and such corrosion-resistant materials as tantalum, tungsten and molybdenum. Alloys containing these metals and other rare metals, such as selenium, are included.

**105. Heat Exchangers.** Griscom-Russell Co., New York, N. Y.—12-page Bulletin No. 1612 describes the Tubefio-type of heat exchanger produced by this company for use with heavy, viscous or sediment-bearing liquids. Details of design and construction are given as is a list of advantages which illustrate the types of application where these heat exchangers may be used.

**106. Magnetic Separators.** Dings Magnetic Separator Co., Milwaukee, Wis.—Three new bulletins describe both the electric and non-electric types of magnets produced by this company for removal of tramp iron from materials in process. They are 4-page Bulletin No. B-1205A, 8-page Catalog No. C-1007A, and 8-page Catalog No. C-1001A. Tables of capacities, dimensions, and advantages of these units are given.

**107. Bearing Materials.** National Bearing Division, American Brake Shoe Co., St. Louis, Mo.—This new bulletin describes the advantages of a silver-base Babbitt metal for use in bearings. Developed during the war, the material is a substitute for similar bearing metals based on tin. Advantages and ease of handling of the material are given.

**108. Packaged Gas Burners.** Bryant Heater Co., Cleveland, Ohio.—6-page Bulletin No. 7C gives capacities, specifications and dimensions of the various types of packaged gas burners produced by this company. These assemblies are complete with pressure blowers. They range in size from 400,000 to 6,600,000 Btu. per hr.

**109. Wood-Lined Pipe.** Michigan Pipe Co., Bay City, Mich.—6-page bulletin describes the various sizes and types of wood-lined pipe produced by this company. For use with corrosive liquids, the pipe is available in diameters of 4 in. and up. Other equipment, including tanks, vats, and cylinders, is briefly described.

**110. Valves.** Sellers Injector Corp., Philadelphia, Pa.—8-page Report No. 94 gives performance data on actual installation of these valves under highly corrosive conditions. Included are applications handling hydrofluoric acid, propane, organic fluorides and hydrocarbons.

**111. Radiant Heaters.** E. L. Wiegand Co., Pittsburgh, Pa.—4-page Bulletin No. CS-603 describes the electric radiant heaters produced by this company for

***Continued on page 340***

These are good for items in this issue only and must be returned by May 31, 1949.


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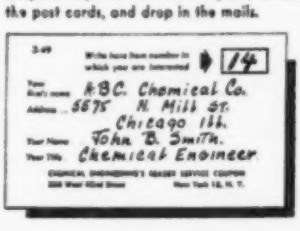
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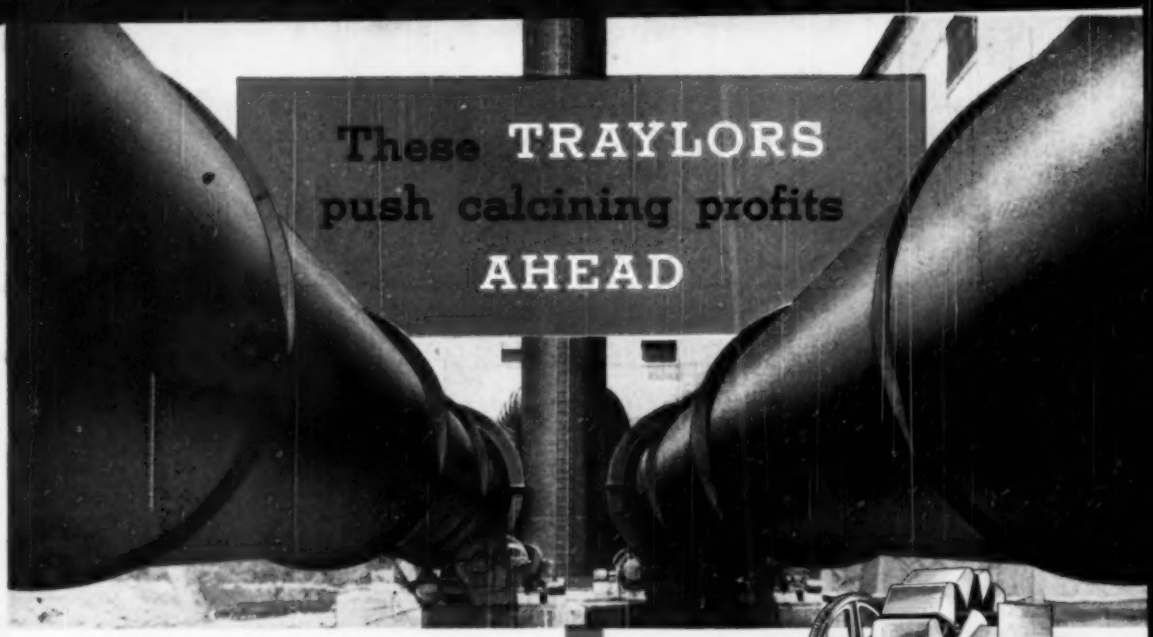
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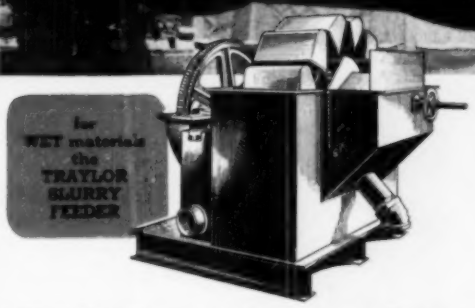

from the carefully aligned shell, the exactly mounted riding rings and the easily adjusted supports come bigger profits in all thermo-processing operations.

## *Because . . .*

**Linings Last Longer · Riding Rings Wear Better · Less Power is required for turning.**

This adds up to *less down time . . . more profit making production hours . . .* with

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**A "Ferris Wheel"** type slurry feeder in a constant-level tank fed accurately by means of an adjustable proportioner. All-welded construction with suitable cover and doors for inspection and clean-out. Fool-proof for any slurry-feeding operation.

*To Get the Biggest Profits from Your Kilns—Maintain their Most Efficient Production Rates with*

## TRAYLOR FEEDERS

*Write for Bulletin 114*

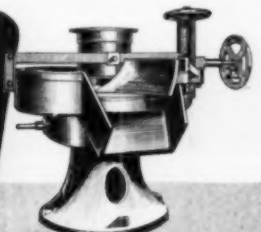
**Operators receive** greatest returns from processing dollars when kilns are kept at peak efficiency by accurate, controlled feed. These two types of Traylor Feeders will handle all materials . . . from wet enough to pour to bone dry . . . in sizes up to three inch . . . with quantities meticulously measured at all times. Traylor Feeders are equally effective for use with dryers, grinding mills and other equipment.



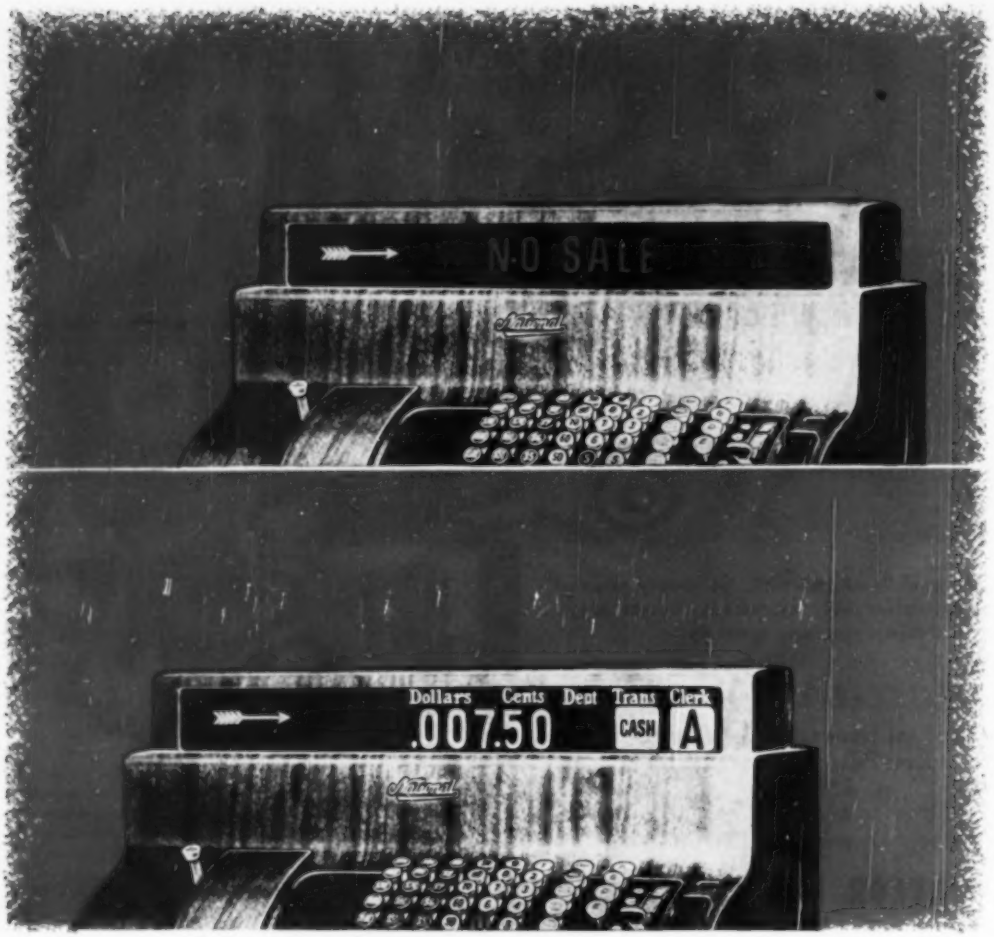

**This horizontal table,** on taper bearings is kept revolving at constant speed by worm gears. Material reaches the table through an adjustable, telescopic tube. Swinging scraper arm removes exact amount desired to kiln or other equipment. Several of these can be teamed to feed different amounts of separate materials.

**Traylor Engineering & Manufacturing Co.**
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Coolers · Dryers
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# the difference is .002 of an inch!

Whether the product is a box of lollypops or luxurious ladies' hose, the difference that makes the sale is often the glossy buy-appeal in the .002-inch lacquer coating on the package!

In inks, on paper and paperboard, lacquer *sells*. Washable, colorless, odorless lacquer adds beauty to printed and unprinted paper surfaces.

Lacquer *saves*, too. Scuff-proof, moisture-proof, grease-proof lacquer keeps packages fresh and attractive for months in storage and on the dealer's shelf.

Beauty, toughness, and its speedy drying qualities make lacquer the preferred surface coating for a wide list of products, ranging from fine furniture to compacts.

CSC butanol, butyl acetate and dibutyl phthalate help make lacquer—industry's most versatile surface coating. These CSC solvents and plasticizers produce the smoothness and toughness that spell more sales and more durability for lacquered papers and paperboard.

If you manufacture lacquer, we suggest that you re-evaluate your lacquer formulas to see what CSC butanol, butyl acetate and dibutyl phthalate can do for you. At today's low prices, fermentation butyls offer you the opportunity to produce the highest quality lacquers without increasing your manufacturing costs.

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CHEMICAL PRODUCTS FOR FACTORY, FARM, HOSPITAL AND HOME

# NEW PRODUCTS AND MATERIALS

*Joseph A. O'Connor*, ASSISTANT EDITOR

CONTENTS


| | |
|---|---|
| Phthalate Plasticizers | 171 |
| Amino Acid Antagonist | 171 |
| Neutron Sources | 171 |
| Xylene Hexafluoride | 171 |
| Plasticizers for Vinyls | 171 |
| Glyceryl Mono Oleate | 172 |
| Corrosion-Resistant Coating | 172 |
| Synthetic Detergent | 174 |
| Skin Astringent | 176 |
| Refrigeration Oil | 176 |
| Phenolic Molding Powders | 176 |
| Surface-Active Agent | 178 |
| Mold Lubricant | 178 |
| Caprylic and Capric Acids | 180 |
| Vapor Phase Inhibitor | 182 |
| Sodium Chlorite Stripper | 184 |
| Hexadecene | 184 |


FOR MORE INFORMATION
See Reader Service
Coupon on pages 167-168

## 51. Phthalate Plasticizers

RECENT additions to the line of organic chemicals manufactured by American Cyanamid Co. are the dioctyl phthalates, di-2-ethyl hexyl phthalate and di-iso-octyl phthalate, which will be marketed under the trade names Aero DOP and Aero DOPI. These plasticizers, now in quantity production at the company's Bridgeville, Pa., plant, are well suited for compounding vinyl resins into films.

These products have low heat loss, a low brittle point and good compatibility. They remain liquid down to temperatures as low as −55 deg C., thus keeping the vinyl film flexible over an extreme temperature range. Their outstanding electrical properties make them excellent products for use in vinyl wire coatings. They are also good plasticizers for nitrocellulose and synthetic rubber, where high tensile strength, low temperature, flexibility and resistivity are desired.

With these products, Cyanamid supplies an important ingredient for that segment of the plastics industry which produces upholstery, drapery materials, shower curtains, imitation leather, handbags, beach mattresses, rain coats, adhesives, shoe products and extruded tubing.

## 52. Amino Acid Antagonist

INTEREST of microbiologists and nutrition experts has been attracted to β,2-thienylalanine since the compound has been found to possess specific activity against amino acids. It is used in medical and biological laboratories as a specific antagonist toward phenylalanine in the metabolism of a number of organisms. This white, soluble, odorless powder is now available for stock delivery from Arapahoe Chemicals, Inc., of Boulder, Colo.

## 53. Neutron Sources

NEW AND improved radium-beryllium neutron sources can now be had from the United States Radium Corp., New York. Two years of research work have resulted in the development of new preparation principles and techniques which have produced sources showing marked improvement in the neutron to gamma emission ratio according to U. S. Radium.

Quantitative measurements of neutron emission are not yet available, but comparative measurements with standard commercial sources indicate a major improvement in neutron output. These new production techniques also have improved duplication of results, so that buyers can now obtain sources that do duplicate in neutron emission.

Sources can be provided in a powdered radium-beryllium mixture or a compressed radium-beryllium mixture, in any size, from a few milligrams content for college laboratory routine experimentation, to 1,000 or more milligrams for special applications. Packaged in stainless steel or magnetic iron capsules, all sources are made to order, and the design or shape of the container can be adjusted to meet special requirements.

Standard polonium-beryllium sources can also be had, and special sources employing beta or gamma activated beryllium can be produced by arrangement with United States Radium Corp.

## 54. Xylene Hexafluoride

PILOT-PLANT production of bis (trifluoromethyl) benzene, or xylene hexafluoride, is now under way at the Hooker Electrochemical Co., Niagara Falls, New York. The product is a mixture containing 60 percent of the para isomer and 40 percent of the meta isomer. A clear, thin, water-white liquid, bis (trifluoromethyl) benzene has a specific gravity at 20 deg. C. of 1.395, a freezing range of −40 to −50 deg. C., a distillation range of 113 to 117 deg. C. and a flash point of 37 deg. C. It can be nitrated and the nitro compound in turn reduced to the amino.

Among possible uses suggested by its chemical and physical properties are: intermediate in the preparation of non-flammable dielectric and hydraulic fluids and starting material for the preparation of dyestuffs. Technical Data Sheet No. 368 describing the product can be secured from Hooker.

## 55. Plasticizers for Vinyls

FLEXOL plasticizer DOP can now be had in two grades with greatly improved color, according to the manufacturer, Carbide & Carbon Chemicals Corp. Plasticizer production facilities at Institute, W. Va., make it possible to produce substantially colorless DOP. This is a particular advantage for compounding clear transparent plastics.

DOP is the plasticizer most widely used with vinyl resins because of its excellent compatibility, permanence, and good low-temperature flexibility. The two new grades of DOP include one having a maximum A.P.H.A. color

Silicone News

DC
STILASTIC

## Increased Volume Cuts Cost of Silastic*

Design engineers weigh the properties and service life of a material against its price per pound. Sometimes there is only one material that will serve the purpose and price becomes relatively unimportant. That has been true of Silastic, the Dow Corning Silicone Rubber. But this initial market for Silastic has now become large enough to permit more efficient production and the opening of new markets through a price reduction of 20 to 45 cents a pound.

**In the aircraft industry** Silastic found a good initial market because it is the only resilient material that withstands hot oil and both high and low temperatures. Typical uses are: sealing thermal anti-icing systems; gasketing engine rocker boxes; and flexible heating ducts.



*Silastic tubing reinforced with glass cloth is used to seal heating and ventilating ducts operating at 350-400° F. in Consolidated's Vultee Convair-Liner, in jet type planes at temperatures of 250-450° F. and under pressures up to 150 p.s.i.*

**In the automotive industry** gaskets are one of many applications for Silastic now under test.

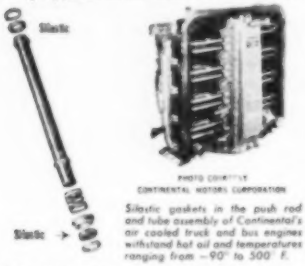



PHOTO COURTESY CONTINENTAL MOTORS CORPORATION

*Silastic gaskets in the push rod end tube assembly of Continental's air cooled truck and bus engines withstand hot oil and temperatures ranging from −90° to 500° F.*

Only Silastic is serviceable at temperatures in the range of −70° to −150° F. and upward of 500° F. It also has exceptional resistance to weathering and to many chemicals, excellent dielectric properties and water repellency. For more information phone our nearest branch office or write for pamphlet No. F5-CD-2.

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of 100 for non-electrical uses; the other, DOP-150, is for electrical uses and has a d.c. resistivity over 2 x $10^5$ megohm per cm. and a power factor under 4 percent with a maximum A.P.H.A. color of 150.

When used in nitrocellulose, DOP combines the advantages of low volatility and good print resistance with cold-check resistance. These properties result in longer life of nitrocellulose finishes, quicker handling after drying, and minimum cracking in cold weather.

DOP-150 is designed for use in products that require specially high dielectric properties.

## 56. Glyceryl Mono Oleate

GLYCERYL mono-oleates are now being produced by a new process. This process makes possible production of lighter colored and more highly surface-active materials at lower costs.

Two grades of the new glyceryl mono-oleates are now being manufactured by Glyco Products Co., Inc., Brooklyn. Both are edible and light yellow liquids. One grade is water-dispersible and soluble in alcohols and oils, and is a powerful oil-in-water emulsifier. The other grade is insoluble in water and soluble in alcohols and oils.

## 57. Corrosion-Resistant Coating

A LINE of corrosion-resistant plastic coatings for the protection of machinery, processing equipment and for general maintenance in factories where corrosives are used has been developed by the Poly-Cyclo Products Co., Cleveland. This line of coatings will be known as CycLon, series NPC. CycLon is an inexpensive, easily applied, high-solids synthetic paint that protects metals, wood and ceramic surfaces against chemical attack by corrosive fumes, condensates and spillage. CycLon air-dries quickly by solvent evaporation to an adhesive, hard-wearing, flexible, glossy coating without the necessity of priming the surface being coated.

Compounding ingredients used in CycLon have been selectively determined by laboratory research to provide the utmost adhesion and resistance to chemical attack without the costly nuisance of using the conventional priming and intermediate coating procedure to achieve a corrosion-resistant film for general maintenance purposes. This is a distinctive economic advantage in itself, yet CycLon goes even further in cutting the cost of corrosion protection, for all NPC

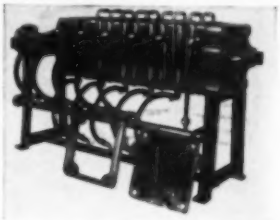

**SO YOUR FILTRATION PROBLEM IS DIFFERENT**

**Yours may be a filtration "toughie." The material may be corrosive or viscous, or it may take high pressure or temperature or treatment with special filter aids under special conditions to make it filterable at an economical flow rate. It may require washing to extract all the filtrate or purge the solids of undesirable liquids. And you think you're stuck with your problem.**

**That's where a Shriver Filter Press can help you, for it's the one piece of filtration equipment that can meet just about any combination of processing obstacles and lick it to your satisfaction. Here are two units built for difficult jobs.**



**Shriver special stainless steel filter press for clarifying film dope at 250 p.s.i. Built with reinforced perforated filter plates furnished with screens and with new Shriver Hydro-Kloser for quick tight closure.**

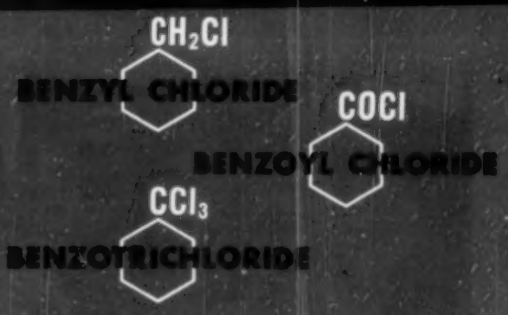


**Shriver special stainless steel washing type filter with large capacity frames for cake recovery and hollow filter plates for hot water circulation to effect filtration at high temperatures.**

***We will gladly test your product in our laboratory without obligation, and recommend the kind of filter press you should have. Write for the new Shriver Filtration Manual.***

SHRIVER
FILTER PRESSES
T. SHRIVER & COMPANY, Inc.
802 Hamilton St. Harrison, N. J.

# HEYDEN CHLORINATED AROMATICS




PUT THE **PLUS** IN YOUR PROCESS...



As solvents and intermediates in the manufacture of pharmaceuticals, dyes, fungicides and organic chemicals, Heyden Chlorinated Aromatics are valuable to many processes and products. The following chart indicates the extensive range they cover.

| CHLORINATED Benzaldehydes | CHLORINATED Benzyl Chlorides | CHLORINATED Benzoyl Chlorides | CHLORINATED Benzotrichlorides | CHLORINATED Toluenes | CHLORINATED Benzoic Acids |
|---|---|---|---|---|---|
| Ortho Chlor Benzaldehyde<br>Assay: 98.0%<br>Containers: Glass carboys | Ortho Chlor Benzyl Chloride<br>Assay: 98.0%<br>Containers: Glass carboys | Ortho Chlor Benzoyl Chloride<br>Assay: 95.0%<br>Containers: Glass carboys | Ortho Chlor Benzotrichloride<br>Assay: 98.0%<br>Containers: Glass carboys | Ortho Chlor Toluene<br>Assay: 99.0%<br>Containers: Glass carboys or iron drums | Ortho Chlor Benzoic Acid, Technical<br>Assay: 97.0%<br>Containers: Wooden barrels |
| Para Chlor Benzaldehyde<br>Assay: 98.0%<br>Containers: Fiber drums | Para Chlor Benzyl Chloride<br>Assay: 97.0%<br>Containers: Glass carboys | Para Chlor Benzoyl Chloride<br>Assay: 98.0%<br>Containers: Glass carboys | Para Chlor Benzotrichloride<br>Assay: 98.0%<br>Containers: Glass carboys | Para Chlor Toluene<br>Assay: 97.0%<br>Containers: Glass carboys or iron drums | Para Chlor Benzoic Acid, Technical<br>Assay: 97.0%<br>Containers: Wooden barrels |
| 2,4-Dichlor Benzaldehyde<br>Assay: 97.0%<br>Containers: Fiber drums | 2,4-Dichlor Benzyl Chloride<br>Assay: 97.0%<br>Containers: Glass carboys | 2,4-Dichlor Benzoyl Chloride<br>Assay: 98.0%<br>Containers: Glass carboys | 2,4-Dichlor Benzotrichloride<br>Assay: 98.0%<br>Containers: Fiber drums | 2,4-Dichlor Toluene<br>Assay: 99.0%<br>Containers: Glass carboys or iron drums | 2,4-Dichlor Benzoic Acid, Technical<br>Assay: 97.0%<br>Containers: Wooden barrels |
| 3,4-Dichlor Benzaldehyde<br>Assay: 96.0%<br>Containers: Fiber drums | 3,4-Dichlor Benzyl Chloride<br>Assay: 96.0%<br>Containers: Glass carboys | 3,4-Dichlor Benzoyl Chloride<br>Assay: 95.0%<br>Containers: Glass carboys | 3,4-Dichlor Benzotrichloride<br>Assay: 96.0%<br>Containers: Glass carboys | 3,4-Dichlor Toluene<br>Assay: 97.0%<br>Containers: Glass carboys or iron drums | 3,4-Dichlor Benzoic Acid, Technical<br>Assay: 97.0%<br>Containers: Wooden barrels |

*Technical literature and samples will be mailed promptly upon request on Company letterhead.*

*Serving Industry Through Fine Chemicals*

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FINE HEYDEN CHEMICALS

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☐ No. 3000 Self-Priming Centrifugal Pumps. Electric Motor and belt driven units. Also portable, gasoline engine units.

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☐ No. 4010-A Single Stage, Side Suction, Single Ball Bearing Centrifugal Pumps. Sizes 1" to 10". Capacities: 10 to 3600 gallons per minute.

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☐ No. 4013-A Single Stage, Side Suction, Two Ball Bearing Centrifugal Pumps. Sizes 1" to 6" discharge. Capacities: 10 to 1200 gallons per minute.

☐ No. 4303 "Motor Mount" Centrifugal Pumps. 63 standard sizes. Capacities from 5 to 650 gallons per minute.

☐ No. 5003 Single Stage, Side Suction, Single Ball Bearing Centrifugal Pumps. Sizes 1" to 10" discharge. Capacities 10 to 3600 gallons per minute.

☐ No. 4700-B Deep Well Turbines. Water lubricated. Vertical, multi-stage construction. Capacities up to 3000 gallons per minute. Various types of heads for most types of power drive.

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☐ No. CR-1 Condensation Return Units and Boiler Feed Pumps. Equipped with various types of standard Deming Pumps to meet all needs. Full range of capacities.

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formulations have high solids content, resulting in a coating of substantial body and hiding power with still a coverage of 350 to 450 sq. ft. of area per gal. per coat when applied by brushing directly from the container.

CycLon coatings are unaffected by all alkalis as well as by salts and by most mineral acids. In addition, CycLon films are inert to alcohols, soaps, water, oxidants, food and fruit acids, oils, aliphatic hydrocarbons, low-octane gasoline and many other corrosive reagents. Since most of these claims can be made for most plastic coatings, corrosion technologists use as a criterion of permanency the moisture vapor transmission rate of the film. It is interesting to note, therefore, that CycLon films of only 0.002-in. thickness have an M-V-T rate of less than 2.0 g. per 100 sq. in. of area for 24 hr. at 100 percent relative humidity.

Non-oxidizing CycLon coatings permanently maintain their flexibility over a wide range of temperatures. They are recommended by the manufacturer for service to 180 deg. F.

CycLon coatings will be sold nationally through Munray Products, Inc., Cleveland, sales division of the Poly-Cyclo Products Co.

### 58. Synthetic Detergent

A NEW synthetic detergent of the alkyl aryl sulphonate type, Kamenol D, has been introduced by the Kamen Soap Products Co., Inc., of New York and Barberton, Ohio. In a recent tabulation of over 500 detergent compounds by a leading expert on synthetic detergents, the new product was given a listing of "excellent detergency."

Kamenol D is a "soapless" soap for hard or soft water. It comes in white bead or slurry paste form which is good in salt solutions. It has highly active ingredients which are clear and soluble in hard or soft water of all proportions. Kamenol D is active in extremely low concentrations and non-irritating to the skin. It forms rich foaming suds and has excellent dispersing properties. Kamenol D mixes well with other ingredients and will not cake. It flows freely, is perfectly stable and softens water promptly and effectively.

Among the uses for Kamenol D are industrial cleaners and laundry com-

# CLOSES MULTIWALLS

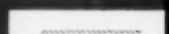
"clam-tight"

## AT HIGH SPEEDS!

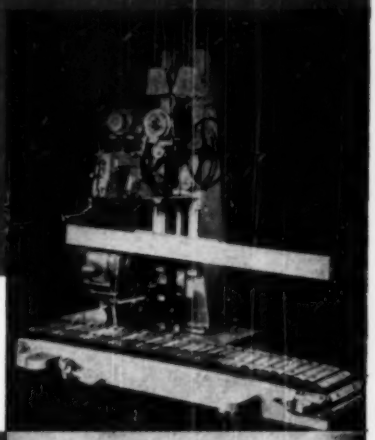
Your packaging time drops sharply when you're operating with a BAGPAKER. Picture the savings from a machine that closes up to 15 heavy-duty multiwall paper bags per minute—a rugged, long-lasting machine, too! And there's more than enough strength in a tough BAGPAKER closure. It's made with the "cushion stitch", which absorbs strains, and won't pull out.

Check the features of both BAGPAKER models shown at the right. One provides high speed, dependable closing; the other, in addition, gives a closure that resists moisture and is proof against contamination and sifting.

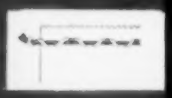
You're apt to discover more profitable closing and handling methods . . . more efficient multiwall bag uses, by discussing your needs with a BAGPAK engineer.

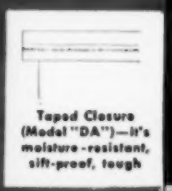


The famous BAGPAK® "cushion stitch"

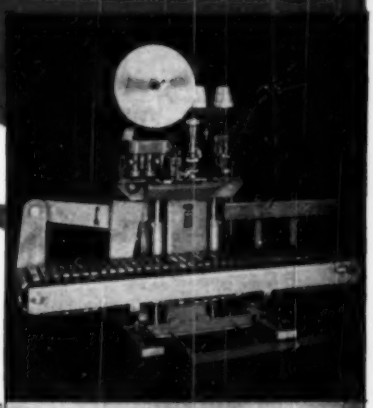


**MODEL "E 1"** (portable)—closes up to 15 bags per minute. A single foot pedal controls both conveyor and sewing head. Handles both paper and textile bags.





Taped Closure (Model "DA")—it's moisture-resistant, sift-proof, tough



**MODEL "DA"** (portable) applies tape over "cushion stitch", making a tight seal. One operator, filling and closing, can handle 2 to 4 bags a minute . . . 6 to 12 where filled bags are delivered to BAGPAKER conveyor. Sewing operation starts and stops automatically—no tape wasted.

BAGPAK DIVISION

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In Canada: Canadian Agent: Products, Ltd., Montreal, Ontario




## New Condenser Cuts Refrigeration Costs Saves Cooling Water

● The Niagara Aeropass Condenser cuts the cost of refrigeration by running compressors at lower head pressure, saving up to 35% of power.

The refrigerant gas passes thru two coils in an air stream. The first, "Duo-Pass"* dry coil, removes the superheat by air cooling and condenses oil vapor. The second, condensing coil, drenched by recirculated water spray, condenses by evaporation, transferring to the air 1,000 BTU for every pound of water evaporated and saving more than 95% of the water used by water-cooled condensers. This done at low temperature, no scale forms on condenser tubes to clog air passage.

Between the two coils is the "Oilout",* which purges the system of crankcase oil and dirt, keeps it always at full capacity.

The "Balanced Wet Bulb"* control holds head pressure low, automatically giving the full benefit of power saving in cool weather and providing always full capacity for peak loads.

Niagara Aeropass design results from over fifteen years' experience condensing by air. It is completely trustworthy for year 'round operation. Users say, "It saves half the difficulties and labor of running a refrigeration plant."

*Units range from 10 to 100 tons capacity. For full information ask for Bulletin 103.*

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*Over 35 Years of Service in Industrial Air Engineering*

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pounds; household cleaners; cotton and wool washing compounds; textile detergent and rug shampoo; automobile washer and metal cleaner; wall, floor and ceiling cleaner; dairy cleaner; wetting and emulsifying agent for insecticides.

### 59. Skin Astringent

ITS SPECIAL dermatological astringent, Chlorhydrol (aluminum chlorhydroxide complex), is now being offered to the drug and cosmetic industries by Reheis Co., Inc., Berkeley Heights, N. J., in solution form. Aluminum chlorhydroxide complex, an active antiperspirant, is less acid in solution than aluminum chloride or aluminum sulphate, and it is correspondingly less corrosive. It is, therefore, less irritating to the skin and less destructive to clothing. It can be used without a buffer. The new solution contains 50 percent solids; it is shipped in wax-lined oak barrels.

### 60. Refrigeration Oil

AN ALL-PURPOSE refrigeration oil has been introduced by Ansul Chemical Co., manufacturer of refrigerants. This oil has been developed to meet the demand of the refrigeration industry for a high quality oil.

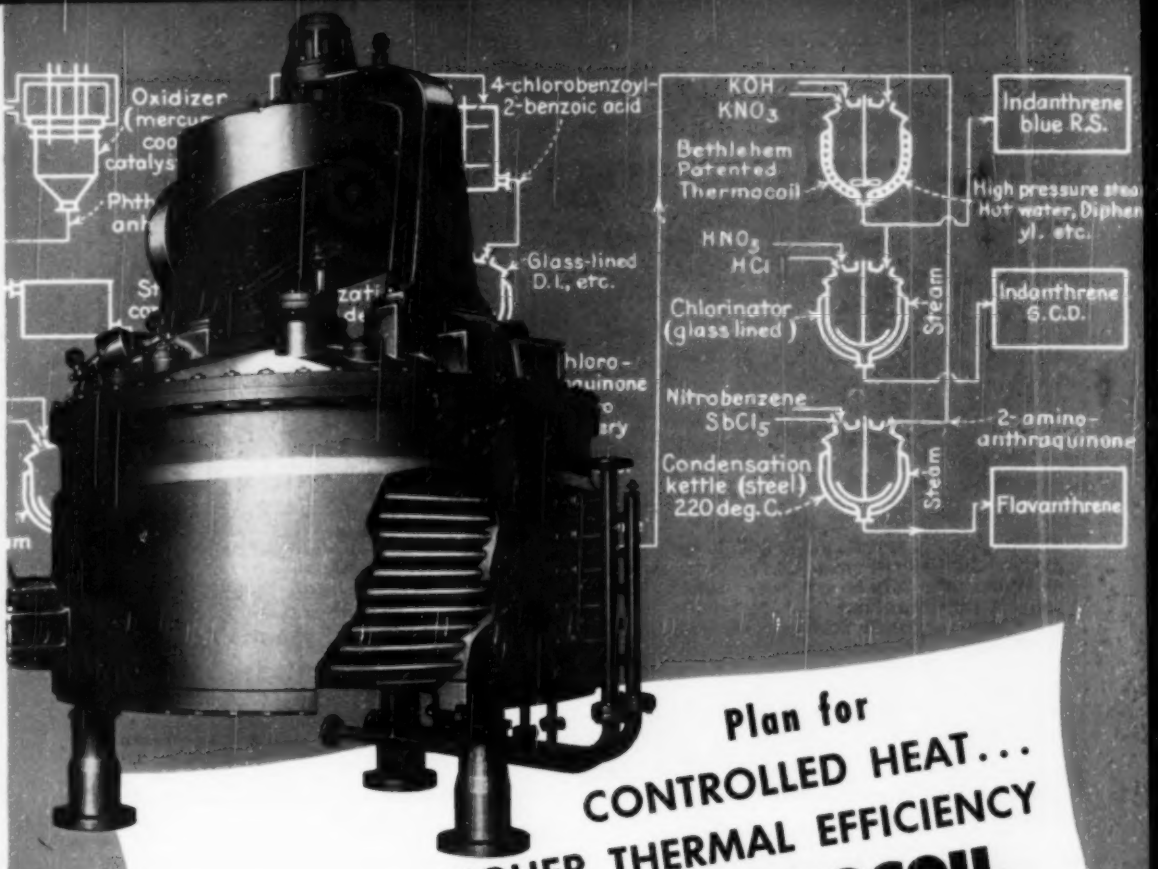
The oil does not separate wax down to −70 deg. F. in oil-refrigerant mixtures. Ansul Oil is regularly tested for low moisture content, low wax content, and high stability. Tests show that the oil has a low pour point and will not decompose to form sludges or acids.

The oil is equally suitable for household refrigerators, deep freezers, meat counters, domestic and commercial cold storage lockers, and all other refrigeration and air conditioning applications.

Ansul Oil will be packaged in 1-gal. cans. It will be on sale at leading refrigeration wholesalers everywhere. Shipments will be made directly from the Ansul plant at Marinette, Wis. Ansul Chemical Co. is a pioneer in wax-separation research.

### 61. Phenolic Molding Powders

A NOVEL group of general-purpose phenolic molding powders which will enable the plastics industry to achieve lower material costs with little or no sacrifice in the properties of high-quality molded parts has been developed by the General Electric Co.'s Chemical Department, Pittsfield, Mass. These new wood flour-filled materials are priced an average of 1c.




## Plan for CONTROLLED HEAT... HIGHER THERMAL EFFICIENCY

# BETHLEHEM THERMOCOIL

When quick temperatures at exact levels are desired . . . and controlled uniformity over the entire interior of the vessel . . . specify Bethlehem Thermocoil equipment.

Its patented construction utilizes a series of coils of steel tubing cast integral with the wall of the vessel. Through these tubes steam, hot water or other liquids under pressure are continuously circulated and provide more rapid rate of thermal transfer. Result? More even distribution of heat accurately controlled, higher thermal efficiency.

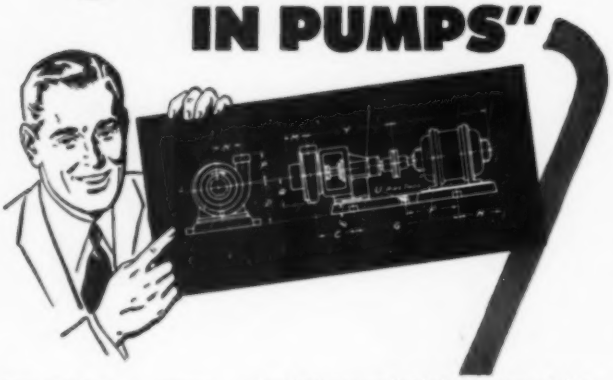
Bethlehem Thermocoil principle assures longer life and eliminates the fire hazard of direct firing on all processes involving the application of heat up to 660° F.

This exclusive Bethlehem equipment is so flexible in application that it is readily adaptable for use with one process or the other—thus eliminating the need of purchasing new equipment. For full details on how Bethlehem equipment can help you in your processing write, wire, or phone.

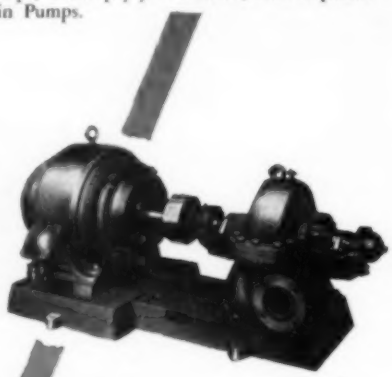
BETHLEHEM

## BETHLEHEM FOUNDRY & MACHINE COMPANY · BETHLEHEM, PENNA.

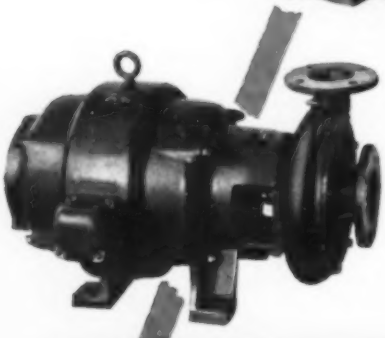
"Career Men IN PUMPS"



One product . . . pumps . . . has had the undivided attention of this company for nearly 60 years. That's why the chemical industry looks to Weinman for help on *any* pump problem. Weinman's advanced methods, creative craftsmanship and "on the job" experience assure you pumps that handle fluids most efficiently. All-Bronze, All-Iron, All-Nickel, All-Aluminum and All-Stainless Steel construction is available in most Weinman Pump modifications and sizes. Whenever you need advice about pumps, it will pay you to write, wire or phone Weinman—Career Men in Pumps.



**TYPE JC TWO STAGE SPLIT CASE PUMP** — These pumps are of the two stage back-to-back impeller design. The rotating element can be removed without disturbing pipe connections. Capacities up to 600 G. P. M. Heads to 600 ft.



**TYPE K SINGLE STAGE UNIPUMP** — Type shown has 3" discharge and 10 H. P. 1750 R. P. M. motor. Discharge nozzle may be placed in any of four positions. Available with mechanical shaft seals to prevent leakage of fluid handled.

*Built by Centrifugal Specialists*

**The WEINMAN Pump Mfg. Co.**

298 Sprure Street • Columbus 8 • Ohio



**FOR MORE INFORMATION**
See Reader Service Coupon on pages 167-168


per lb. below the market price of other general-purpose molding powders.

The four compounds—black and brown for compression and transfer molding—have a specific gravity of 1.37, and are said to have flow characteristics, cure time and water resistance nearly equal to more costly wood flour-filled phenolics.

Although the new materials do not have a high gloss on long-draw moldings and may show a slightly less rigid discharge from the mold, tests by General Electric indicate that they are highly satisfactory for the majority of thermosetting plastics applications.

### 62. Surface-Active Agent

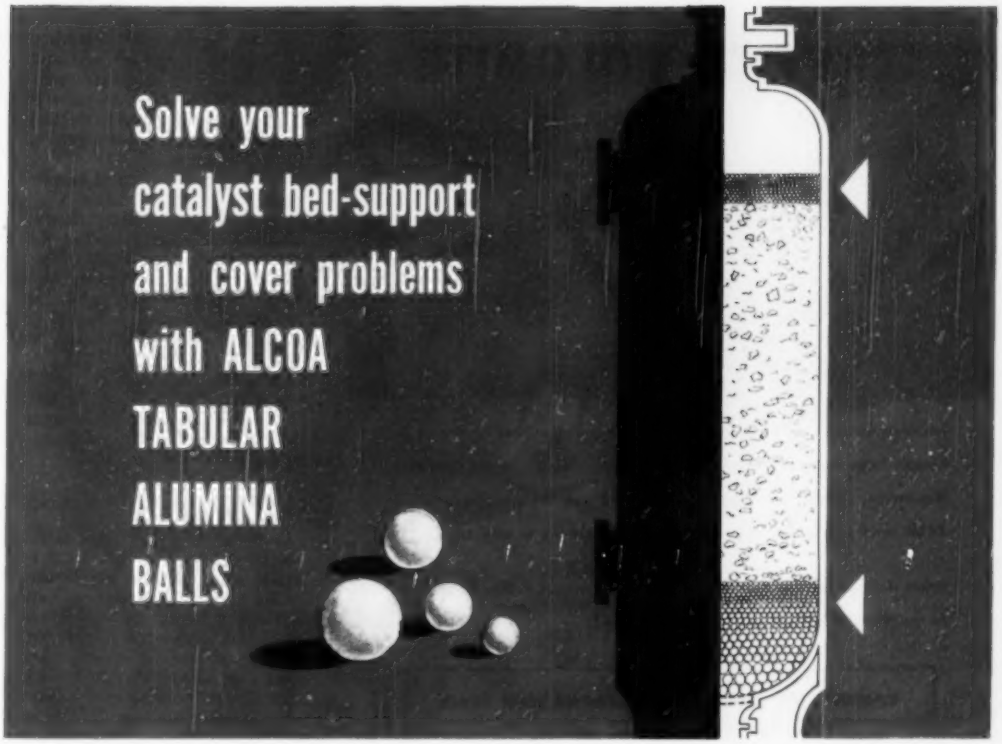
A CONCENTRATED alkylated aromatic sulphonate, said to show nearly twice the wetting-out action of the conventional alkylated aromatic sulphonates, is being marketed as Hartofol C by the Hart Products Corp., New York. A liquid gel, Hartofol C is stable to both organic and mineral acids, as well as all alkalis. It can be used satisfactorily in water of any hardness and in the presence of salts, soaps and emulsions.

From an economy viewpoint, Hartofol C is claimed to be one of the fastest wetting agents on the market. In addition to its wetting action, it shows good detergency, particularly in the presence of alkalis and phosphates, and good sudsing action. Hartofol C is used wherever its superior wetting-out, rewetting and scouring action are required.

It is recommended for vat or pad dyeing, for package dyeing and dyeing operations in general to give greater uniformity of shade. Added to printing pastes it improves penetration and gives better fastness to soaping. Hartofol C finds application in such textile processing as raw wool scouring; wool carbonizing; wool piece goods dyeing; rayon, acetate and cotton boil-off; rayon and acetate dyeing; and print washing and dyeing.

### 63. Mold Lubricant

SPECIALLY created to eliminate difficulties often encountered in the plastics industry, a new mold release material has been announced by Bee




These hard ceramic balls may make a lot of difference in the operation of your reactor towers. They provide:

**Higher Efficiency . . . Better Operation . . .**

—The stream is evenly diffused across the catalyst bed . . . Resistance to stream flow is reduced.
—Ceramic balls replace fine mesh inside screens.
—The cover prevents "dancing" of the catalyst when flow is upward . . . Diffuses the stream when flow is downward . . . Holds catalyst in place, should surges occur.
—High purity (99+ % $Al_2O_3$) . . . High resistance to acids and alkalis . . . Chemically and catalytically inert to most products.

**Economy . . .**

—Simplifies supporting grid.
—High resistance to abrasion, mechanical shock and thermal shock . . . Can withstand sudden temperature changes of more than 1000° C. (1832° F.).

**Adaptability . . .**

—Any depth of bed-support and cover can be used . . . Five sizes of balls—from ¼" to ¾"—permit a selection best suited to your process.

In addition to their uses as bed-supports and covers, ALCOA Tabular Alumina Balls also offer you money-saving advantages when used as a heat-exchange medium. They have both high heat capacity and high heat conductivity.

*Specific heat (at 1000° C.) = 0.3 cal./g./° C.*
*k (at 800° C.) = 0.009 to 0.010 cal./sec./sq.cm./cm./° C.*

ALCOA Tabular Alumina Balls may help solve a difficult problem. Let us tell you more about this unique form of alumina. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 1778 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA

# ALCOA CHEMICALS

## ALUMINAS AND FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • LOW SODA ALUMINAS • TABULAR ALUMINAS • HYDRATED ALUMINAS
ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE

# ACRES OF DOLOMITE



**Looming large in their potentialities for chemical utilization are Oklahoma's huge deposits of dolomite. In Murray County, in the Arbuckle Mountains, (south central part of the state) one deposit alone covers 1400 acres with a thickness of 550 feet. Its quality is very high.**

**Other deposits are available elsewhere in the Arbuckle Mountains, and in the Wichita Mountain area (near Lawton).**

**REPRESENTATIVE ANALYSIS OF OKLAHOMA HIGH-GRADE DOLOMITE**
(Analyzed by Oklahoma Geological Survey)
**ROYER DOLOMITE—MURRAY COUNTY**
Representing 230 Foot Thickness

| | Percent | | Percent |
|---|---|---|---|
| CaO | 30.680 | $Al_2O_3$ | 0.170 |
| MgO | 21.250 | $P_2O_5$ | 0.005 |
| $K_2O$ | 0.053 | S | 0.010 |
| $Na_2O$ | 0.028 | $H_2O$ @ 105° | 0.030 |
| $SiO_2$ | 0.300 | Ignition loss | 47.340 |
| $Fe_2O_3$ | 0.150 | | |
| Total oxides | 100.056 | | |

**Detailed information on Oklahoma's mineral resources is available on request, based on data by the Oklahoma Geological Survey. Map showing location of mineral deposits is also available.**








Chemical Co., Chicago. Known as Logolube, the new material is a liquid, and hence easier to apply and control than dusts which are often used for the purpose. The makers claim that less Logolube is required to do the job than would be required if other liquid lubricants were used.

One major advantage of Logolube, according to Bee Chemical Co., is the fact that it does not interfere with painting or Logoquant treating of the molded parts. If desired, it can be removed from the plastic by mere wiping with a cloth wet with alcohol. Logolube may be thinned for spraying on the mold or may be applied with a brush.

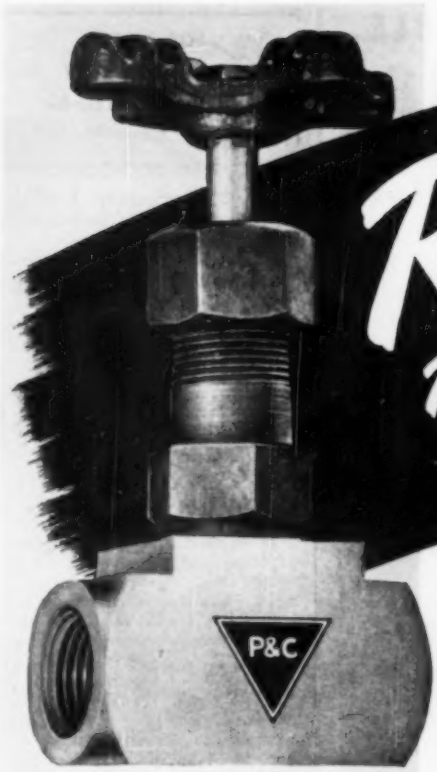
Extensive experimental use has proved the qualities of Logolube, which is now available for prompt deliveries in reasonable quantities, according to the manufacturer.

## 64. Caprylic and Capric Acids

Caprylic acid and capric acid are now being made available by the El Dorado Oil Works of San Francisco for use in pharmaceuticals, cosmetics, economic poisons, mineral flotation agents and as chemical intermediates.

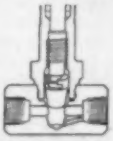
A typical analysis of the caprylic acid shows an acid number of 383, a saponification number of 386 and an iodine number less than 1. The acid melts at 11.1 deg. C., and its moisture content is 1.6 percent. A breakdown of its fatty-acid composition shows 7.5 percent caproic acid, 90.4 percent caprylic acid and 1.8 percent capric acid. Analysis of the capric acid gives an acid number of 315 and a saponification number of 316, as well as an iodine number of less than 1. Capric acid melts at 28.0 deg. C., and its moisture content is 0.5 percent. It analyzes 93.2 percent capric acid, with 1.7 percent caprylic acid and 4.8 percent lauric acid.

As a bactericidal and fungicidal agent, an ointment containing 9 percent sodium caprylate and 1 percent free caprylic acid has been effectively used in treating ringworm of the foot. By compounding 1–2 percent in soap-base shampoos, the danger of free alkali is eliminated without affecting the free-rising characteristics that are required. In the field of economic poisons, caprylic acid has been used for the production of copper and zinc caprylates. These are used as fungicides. Other toxic materials have likewise been prepared. Sodium caprylate can be used in the separation of some non-metallic ores. An important use of these acids is as chemical intermediates for esterification reactions. These reactions produce flavors, perfumes, surface-active agents and plas-

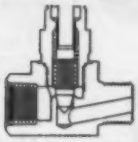



# R-P&C BAR STOCK VALVES

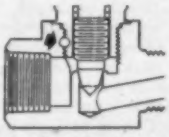
**RUGGED**
**ECONOMICAL**
**DEPENDABLE**
**VERSATILE**



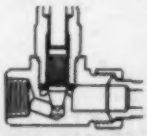
**THRU-PORT**—for handling heavy liquids which carry suspended solids or where precipitates or deposits cause trouble.



**MALE and FEMALE END**—Available in both Globe and Angle valves—useful for many special hook-ups.



**LOCK BONNET**—for lines carrying hazardous liquids or where there is extreme vibration.



**UNION END**—where frequent disassembly is required or to use instead of a break elsewhere in the line.

Following is a tabulation of working pressures of these valves:

| MATERIAL | FIGURE NO. Globe | Angle | WORKING PRESSURE |
|---|---|---|---|
| BRONZE | 1030 | 1031 | 500 lbs. at 150°F |
| CARBON STEEL | 1040A | 1041A | 4000 lbs. at 150°F |
| | | | 600 lbs. at 750°F |
| | | | 550 lbs. at 900°F |
| | | | 475 lbs. at 1000°F |
| 12-14 CHROME STAINLESS STEEL | 1050 | 1051 | 4000 lbs. at 150°F |
| COMBINATION | 1060 | 1061 | 4000 lbs. at 150°F |
| 12-14 CHROME STAINLESS STEEL | | | 600 lbs. at 750°F |
| | | | 550 lbs. at 900°F |
| CARBON STEEL | | | 475 lbs. at 1000°F |
| 18-8 STAIN. STEEL (TYPE 316) | 1070A | 1071A | 4000 lbs. at 150°F |
| THRU PORT VALVES 1045A | | | 1000 lbs. at 150°F |
| | | | 600 lbs. at 750°F |
| | | | 550 lbs. at 900°F |
| | | | 475 lbs. at 1000°F |

For more complete information, get in touch with your Reading-Pratt & Cady distributor or the District Office nearest you. Or, if you prefer, write direct to the factory at Reading, Pa.

**ACCO**

Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit
Houston • New York • Philadelphia • Pittsburgh • San Francisco • Bridgeport, Conn.

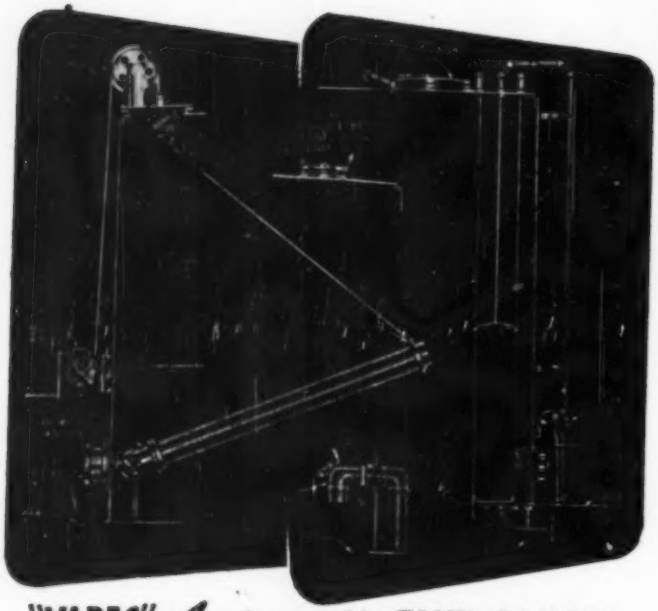
TRADE MARK

**R-P & C VALVE DIVISION**
**AMERICAN CHAIN & CABLE**

**READING-PRATT & CADY VALVES**

ACCURATE and RELIABLE

TANK ACCESSORIES
for *Convenient* Operation



"VAREC" *Automatic* TANK GAUGES
and SWING LINE EQUIPMENT

Designed for all types of tanks and corrosive conditions, VAREC Automatic Tank Gauges afford you a safe, accurate, economical means of measuring liquid levels . . . conveniently, and as often as necessary. Gauges operate on a float actuated tape; give reliable readings in an eye-level lookbox outside the tank.

VAREC Swing Line Equipment is especially designed to provide a rapid, convenient method for withdrawal of liquids at various levels. Essentially, it consists of winch and swing joint for raising and lowering of a standpipe.

VAREC gauge hatches, water drawoff valves, drain ells, internal check valves, etc. will safely and reliably complete your tank installation. *Check your needs today.*

CP-12

PROVED and APPROVED "Varec" THE VAPOR RECOVERY SYSTEMS COMPANY
COMPTON, CALIFORNIA, U.S.A.
NEW YORK PITTSBURGH CHICAGO TULSA HOUSTON
CABLE ADDRESS: VAREC COMPTON 1A1 CODES

FOR MORE INFORMATION
See Reader Service
Coupon on pages 167-168

ticizers. The acids can also be used in chemical synthesis for hydrogenation to the corresponding alcohols.

El Dorado is now supplying both caprylic acid and capric acids in 1-gal. bottles and 55-gal. drums.

### 65. Vapor Phase Inhibitor

Boon to the ferrous metal industries is the new chemical VPI (vapor phase inhibitor) designed by the Shell Development Co. It is a volatile corrosion inhibitor. Angier Corp. of Framingham, Mass., has been licensed by Shell to manufacture and market VPI.

By application of VPI to Angier papers a new and complete rust-preventive packaging method is made possible. More than just a non-corrosive paper, Angier VPI Wrap is a simplified and highly effective corrosion barrier.

VPI slowly vaporizes from the Angier wrapper. This VPI vapor forms an invisible protective film around the steel article that prevents corrosion. Therefore, Angier VPI Wrap need not be in direct contact with the steel surface to prevent corrosion.

Angier VPI Wrap affords prolonged protection against corrosion under severe conditions of humidity and temperature. It prevents spreading of rust when some rust already exists. With it, fingerprint corrosion can be held in check.

With Angier VPI wrap, ordinary wrapping procedure is enough to assure protection of all parts of the steel article. A tightly sealed, puncture-proof package is not essential. Temporary exposure of Angier VPI Wrap to the air does not destroy its effectiveness. More laborious methods of preventing corrosion are eliminated.

Because articles preserved in Angier VPI Wrap require no grease or slushing oil coating, cleaner packages result, sales appeal is increased, and the time and labor required to remove the oil coating is saved.

While it was developed primarily for protective packaging of articles made of bare steel or aluminum, Angier VPI Wrap is also recommended for protection of steel stock in temporary storage, between processing steps and for protection of stored machine or hand tools.

Angier VPI Wrap is immediately

# AVAILABLE

## IN DRUMS OR TANK CARS

# ENJAY Oxygenated Solvents and Hydrocarbons

As the chemical marketing affiliate of Esso Standard Oil Company, ENJAY* COMPANY is backed by the nation's largest petroleum research facilities. To our customers this means prompt delivery in any quantity—from drums to tank cars—of top quality, uniform, oxygenated solvents and hydrocarbons.

For complete information on uses and properties of the ENJAY products listed below, drop us a line today. You'll find our technical staff always ready to supply any data and guidance you may need. Write today.

**ENJAY SOLVENTS**

PETROHOL* Isopropyl Alcohol (91%, 99%)—$CH_3CHOHCH_3$
Secondary Butyl Alcohol—$CH_3CHOHCH_2CH_3$
Isopropyl Acetate—$CH_3COOCH(CH_3)_2$
Secondary Butyl Acetate—$CH_3COOCHCH_3(C_2H_5)$
Isopropyl Ether—$C_3H_7OC_3H_7$
Methyl Ethyl Ketone—$CH_3COC_2H_5$

**ENJAY HYDROCARBONS**

Butadiene—$CH_2:CHCH:CH_2$
Isobutylene—$CH_2:C(CH_3)_2$
Diisobutylene—$CH_2:C(CH_3)CH_2C(CH_3)_3$†
Triisobutylene—$CH_2:C(CH_3)CH_2C(CH_3)_2CH_2C(CH_3)_3$†

† Other isomers also present.

**CTLA POLYMER**—An economical heat-reactive, aromatic-type olefinic hydrocarbon. Highly unsaturated. Dries by polymerization and oxidation. Miscible in all proportions with drying oils. Compatible with most resins.



ENJAY

**ENJAY COMPANY, INC.**
**15 West 51st Street, New York 19, N. Y.**

* Trade Marks

*You know that - -*

HIGH VACUUM PUMPS REQUIRE CLEAN OIL!
free from abrasive solids, varnish forming substances, and especially volatile contaminants which raise vapor pressure and decrease processing efficiency.

*. . but do you know*

that oil can be purified easily by complete removal of all contaminants on a continuous, full-flow basis after each pass through a vacuum pump, resulting in continuous pump operation at maximum efficiency, and in elimination of oil waste?

*Ask . .*

these manufacturers of refrigeration compressors—

| | |
|---|---|
| Carrier Corporation | York Corporation |
| Seeger Refrigerator Company | Universal Cooler Division |
| Liberty Motors Corporation | Tecumseh Products Company |
| Jack & Heintz Precision Ind. | Norge Division |

. . or these manufacturers of chemicals and pharmaceuticals —

| | |
|---|---|
| E. R. Squibb & Sons | Merck & Co., Inc. |
| Chas. Pfizer & Co., Inc. | Winthrop Chemical Co., Inc. |
| Bristol Laboratories, Inc. | Commercial Solvent Corp. |
| Carbide & Carbon Chemicals Corp. | Lederle Laboratories Div. |
| Distillation Products Co. | The Upjohn Co. |
| J. T. Baker Chemical Co. | Sharp & Dohme |

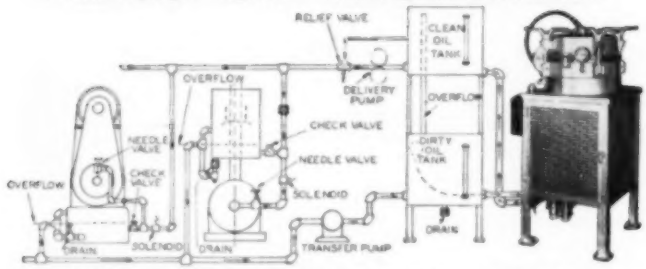
or these manufacturers of condensers, capacitors, transformers, electron tubes, and other electrical equipment—

| | |
|---|---|
| Aerovox Corporation | Picker X-Ray Corp. |
| General Electric Co. | Sprague Electric Co. |
| Line Material Co. | Stromberg-Carlson Co. |

. . or manufacturers of optically coated lenses, metallized paper, cyclotrons . . . in short any manufacturer using high vacuum rotary pumps.

*Ask* them about the

**HILCO OIL RECLAIMER**




HILCO Continuous Vacuum Pump Oil Purifying System. Oil purified at a fraction of a cent per gallon. Write for Bulletin R-160

*better still ask us . .*

**THE HILLIARD CORPORATION**

**131 West Fourth St., Elmira, New York**


available in two grades, the No. 310 and No. 610, using 30-lb. and 60-lb. neutral kraft respectively, coated with a concentration of 1 g. of VPI per sq. ft. Standard rolls are 36 in. wide by 400 yd. long for No. 310 and 36 in. wide by 200 yd. long for No. 610. Narrow rolls and sheets can be had on special order.

Angier Corp. manufactures protective papers and spiral wrapping equipment.

## 66. Sodium Chlorite Stripper

NYLON stripping with almost complete dye removal may now be accomplished essentially without damage to the nylon fiber through the use of Textone, a sodium chlorite product, developed by Mathieson Chemical Corp. The new process employing Textone may also be used for partial stripping. In either case, Mathieson claims, the chlorite exhibits its characteristic ability to attack color bodies with a minimum degradation of the fiber.

Employing conventional equipment, the process is faster and gives more uniform results than other stripping methods, according to the manufacturer. For partial stripping, the goods are treated in a bath containing sodium chlorite and detergent, to which formic acid is added. After 30 min. in the stripping bath, the goods are rinsed and are then ready for redyeing.

For complete stripping, the goods are first treated in a bath containing acetic acid and synthetic detergent, to which zinc formaldehyde sulphoxylate is added. After rinsing, the goods are stripped in a sodium chlorite bath.

Sodium chlorite has been in use for many years as a stripping agent for other textiles. Its introduction to the nylon field, according to Mathieson, promises to the nylon dyer an easy and safe solution to the problem of reprocessing off-shade dyeings.

## 67. Hexadecene

HEXADECENE, a moderately priced olefin raw material with interesting possibilities in organic syntheses, is now available in research quantities from the Houdry Process Corp. Besides its utilization in many olefin reactions, hexadecene should be of interest because of some of its physical properties. Its pour point is less than −50 deg. C. Its flash point is 90 deg. C., and its boiling point, 242 deg. C. Viscosity of hexadecene ranges from 3.57 centistokes at 38 deg. C. to 1.33 centistokes at 99 deg. C.

*Presenting*

# NYTRON

TRADE-MARK REG. U. S. PAT. OFF.

*a totally different type of*

*Synthetic Organic Detergent*

*with an* **EXCLUSIVE**

**COMBINATION OF PROPERTIES**

**EXCEPTIONAL detergency**

**UNIQUE solubility range**

**UNCOMMON chemical stability**

**UNUSUAL resistance to hard water**

**DEPENDABLE wetting and emulsifying action**

**The exclusive** composition of NYTRON offers you a combination of properties never before available in any single synthetic organic detergent. As a result, NYTRON has already found unique application in a wide range of industries. For example . . . NYTRON is gentle enough for laundering sheer synthetic fabrics, yet powerful enough to clean greasy overalls or aid in the pickling of steel. Send for technical data and specific information on how NYTRON can be used to advantage in your business. Mail the coupon now.

**A SOLVAY PRODUCT**

**Get All the Facts on NYTRON . . .**

**Mail this Coupon NOW**

**SOLVAY SALES DIVISION,** Allied Chemical & Dye Corporation
**40 Rector Street, New York 6, N. Y.**

I want to know more about NYTRON, the entirely *new type* (patented) Synthetic Organic Detergent, and what it can do for my business. Please send me detailed non-technical information and specific technical data on NYTRON.

Name .....

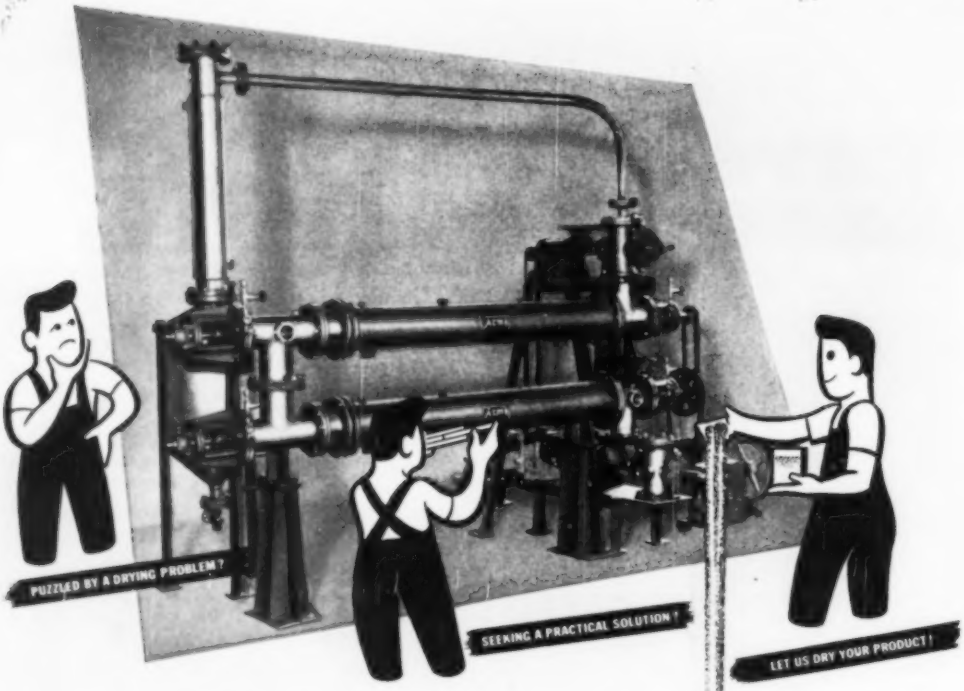
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Company .....

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## *Now available for TESTS...*

# The Acme PILOT DRYER!

The Acme Multi-Stage Continuous Dryer here illustrated was especially constructed for pre-testing the drying of granular or crystalline chemicals or of organic materials such as grain, starch or meal. It may also be used for solvent extraction under vacuum, atmospheric or higher pressures.

Acme Multi-Stage Continuous Dryers provide maximum operating economy in a wide variety of applications. Consisting of stationary, welded, jacketed cylinders, they may be fitted with internal rotary conveying and mixing type paddles, ribbons or screws. The internal parts are readily accessible for cleaning or withdrawal.

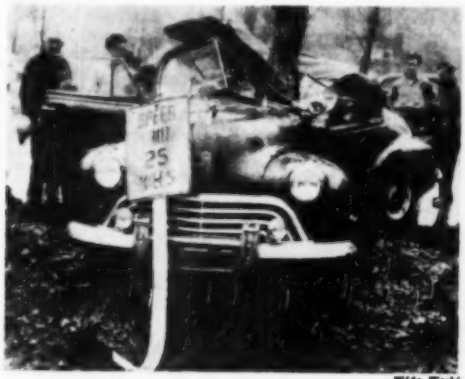
There is no obligation for conducting a test of your product with this flexible experimental dryer. Results should be of considerable value in the subsequent planning of your own equipment. Further information is available on request.

**COMPLETE DRYING SYSTEMS**
**DRUM DRYERS**
**SPRAY DRYERS**
**FLASH DRYERS**
**ROTARY STEAM DRYERS**
**ROTARY FLUE GAS DRYERS**

**ACME** *Processing Equipment*
ACME COPPERSMITHING & MACHINE CO., OAKLAND, PA.

# MEN, MACHINES AND METHODS

*Roger Williams, Jr.*, ASSISTANT EDITOR



Wide World

Major Killers—By Rank

| Year | Heart | Accidents | Cancer | Pneumonia | Tuberculosis | Cerebro Vascular | Nephritis |
|---|---|---|---|---|---|---|---|
| **By Number of Deaths** | | | | | | | |
| 1930 | 1 | 6 | 3 | 2 | 7 | 9 | 4 |
| 1935 | 1 | 6 | 2 | 3 | 7 | 4 | 5 |
| 1940 | 1 | 5 | 2 | 6 | 7 | 3 | 4 |
| 1945 | 1 | 4 | 2 | 6 | 7 | 3 | 5 |
| **By Life Years Lost** | | | | | | | |
| 1930 | 2 | 3 | 5 | 1 | 6 | 7 | 6 |
| 1935 | 1 | 3 | 5 | 2 | 4 | 7 | 6 |
| 1940 | 1 | 2 | 4 | 3 | 5 | 6 | 6 |
| 1945 | 1 | 2 | 3 | 4 | 6 | 5 | 7 |
| **By Working Years Lost** | | | | | | | |
| 1930 | 4 | 3 | 5 | 1 | 2 | 7 | 6 |
| 1935 | 3 | 2 | 5 | 1 | 4 | 7 | 6 |
| 1940 | 2 | 1 | 5 | 3 | 4 | 7 | 6 |
| 1945 | 2 | 1 | 4 | 3 | 5 | 6 | 6 |

## Accidents—The Worst Killer

**Unrealized working years from accidental deaths are greater than from heart disease or cancer, point up the need for more teaching of accident prevention off the job as well as on.**

AT CERTAIN times in the year various organizations come around asking for money to combat this disease or that one. Tuberculosis, cancer, infantile paralysis, and so on, all put on their campaigns. We have been wondering for a long time which of the various killers was the worst. Well, we finally found out. It is accidents!

Measured by the number of working years lost to the nation as a whole, accidents rank as the worst cause of death. That fact alone ought to cause engineers, particularly safety engineers, to preach accident prevention even harder than in the past.

This fact has come out of a recent bit of statistical work done for the American Medical Association, some statistical work that should have been done long ago. The work is published in a monograph called "What is the Leading Cause of Death?—Two New Measures," by Drs. Dickinson and Welker of the Bureau of Medical Economic Research.*

What these men have done is to change the basis for considering death causes. In the past, people have talked primarily about the *number* of people dying from a given disease or death cause. But this type of measurement does not give an idea of what the nation lost due to a particular death. Certainly it is a greater loss to the nation to have a 25-year-old die in an accident than to have an 80-year-old die of heart attack.

### The New Measures

Here is what the authors have to say about their new death-cause measures: "In view of the variations in the average age of persons dying from the seven leading causes, we suggest that number of deaths alone is no longer a completely definitive measure of the loss to society resulting from a given cause of death. As supplements to this traditional measure, we present in this monograph two new measures for ranking the causes of death. Both of these measures take into account the factor of age at death. Both are designed to gage only the loss to society resulting from the various causes, not the infinite loss of the gift of life to the dying person or to his family. . . .

"How can the age factor be incorporated into measures of the loss to society resulting from the leading causes of death? Obviously that loss would not be reflected by the number of years the decedent had lived; rather it would depend upon the average number of years other persons of his attained age at death can be expected to live. This means that we wish to apply life expectancy values to the dying. Of course the 'lost years of life expectancy' would have been realized only over a period of many future calendar years; that is, the loss is 'unrealized' in the calendar year in which a death occurs. . . .

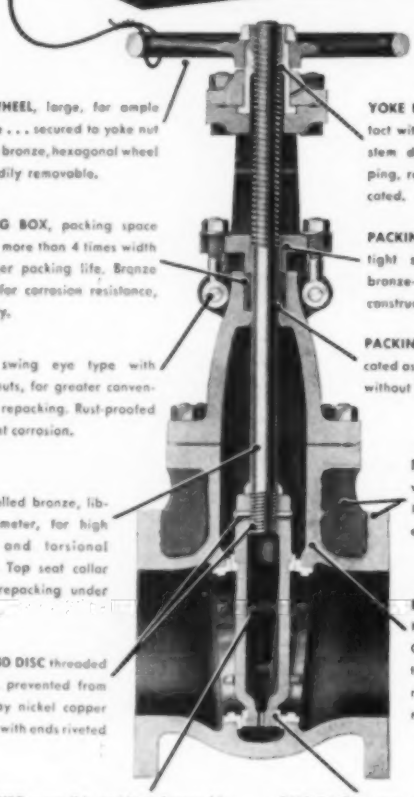
"The first new measure is called *life years lost*. The number of life years lost is obtained for each cause by multiplying the life expectancy at a given age by the number of people dying at that age from the given cause and then adding the products for all ages. . . .

"The second new measure is called

* Dr. Welker, incidentally, is primarily a mathematician.

# Precision Engineering Makes this KENNEDY VALVE Rugged and Dependable...

**KENNEDY STANDARD IRON BODY WEDGE GATE VALVE**
**Fig. 0611, outside-screw-and-yoke. Service up to 125 lb. p.s.i. steam; 200 lb. p.s.i. water, oil or gas. 1½" through 48" sizes available.**



**HANDWHEEL**, large, for ample leverage . . . secured to yoke nut by large bronze, hexagonal wheel nut, readily removable.

**STUFFING BOX**, packing space depth is more than 4 times width for longer packing life. Bronze bushed for corrosion resistance, durability.

**BOLTS**, swing eye type with washer nuts, for greater convenience in repacking. Rust-proofed to prevent corrosion.

**STEM**, rolled bronze, liberal diameter, for high tensile and torsional strength. Top seat collar permits repacking under pressure.

**STEM AND DISC** threaded together, prevented from turning by nickel copper alloy pin with ends riveted over.

**WEDGE DISC**, reversible and interchangeable, reinforced by integrally cast interior posts. Openings permit drainage in any position.

**YOKE NUT**, bronze, thread contact with stem at least 1½ times stem diameter eliminates stripping, reduces wear, easily lubricated.

**PACKING GLAND** machined for tight seal with stuffing box, bronze-bushed at stem. Slotted construction simplifies repacking.

**PACKING**, molded rings of lubricated asbestos maintain tightness without excessive gland pressure.

**FLANGES** are heavy and well filleted. Flanged ends have reinforcing ribs for extra strength.

**BODY AND BONNET**, Kennedy Higher Strength Cast Iron, generous metal thicknesses and well rounded corners provide maximum strength.

**DISC RINGS**, bronze, wide and thick, forced into dove-tailed grooves in disc to form practically integral construction.

*Write for Bulletin No. 50. BUY FROM YOUR LOCAL DISTRIBUTOR*

The **KENNEDY** VALVE MFG. CO.
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ELMIRA, NEW YORK
VALVES • PIPE FITTINGS • FIRE HYDRANTS

OFFICE-WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO • SALES REPRESENTATIVES IN PRINCIPAL CITIES


*working years lost*. The number of working years lost is calculated in a manner similar to the number of life years lost except that the years to be lived before the 20th and after the 65th birthdays are excluded . . . because this period (between ages 20 and 65) is the earning period of life according to the usual working habits of persons in this country."

### Cost of Accidents

The results of these two new measures are shown in the table. They dramatically cast a new light on death causes. They make the role of accidents in our nation's health readily apparent. In 1945 there were 96,000 deaths from accidents, but there were 424,000 deaths from heart disease. But when measured by working years lost to the nation, accidents lost us 1,760,000 years and heart disease 1,684,000 years. Certainly, we do not want to diminish the importance of medical research on heart diseases. What we want to emphasize is *the underemphasized cost of accidents!*

Once we realize the role of accidents, perhaps we can do something about them. Then we can think about another thing. Only 15-20 percent of the accidental deaths are occupational. That is probably due in part to the active safety programs most companies have. We should certainly not cut down on our in-plant safety programs, but perhaps we should vastly increase our efforts to make people safety-conscious off their jobs.

* * *

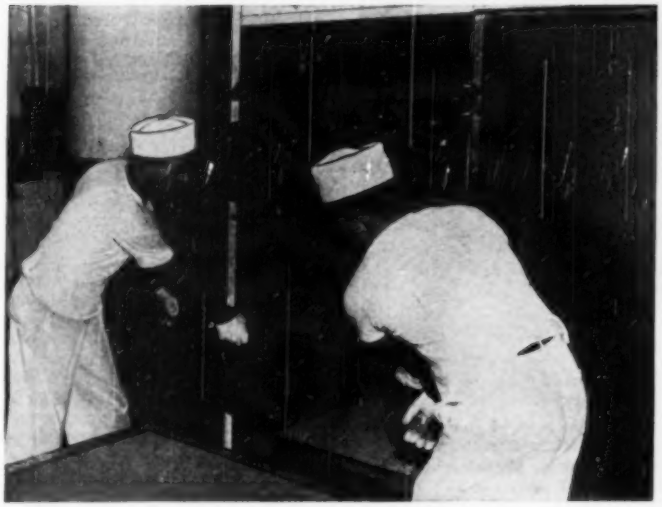
One paragraph in the monograph referred to above made us do a little extra digging: "Those who plan medical research and health improvement programs might well turn from mere number of deaths alone and also consider life years lost and working years lost before reaching conclusions about the relative importance to society of the six leading natural causes and the one violent cause of death."

Well, that sounded interesting, so we dug up a fabulous volume called "The Nation's Health—A Ten Year Program." This volume, all 186 pages of it, is the report to the President by Oscar R. Ewing, Federal Security Administrator. It is the basis for the recent recommendation by President Truman that, "We must have, without further delay, a system of prepaid medical insurance which will enable every American to afford good medical care."

Now, we didn't and don't want to get into the argument over socialized medicine or national health insurance plans. What we were interested in was the extent to which the FSA ad-

CHEMICAL Drying DATA
BULLETIN 12
PUBLISHED MONTHLY FOR PROCESS INDUSTRIES EXECUTIVES AND OPERATING PERSONNEL

# THRU-CIRCULATION TRAY DRYERS speed processing, where physical characteristics of product permit

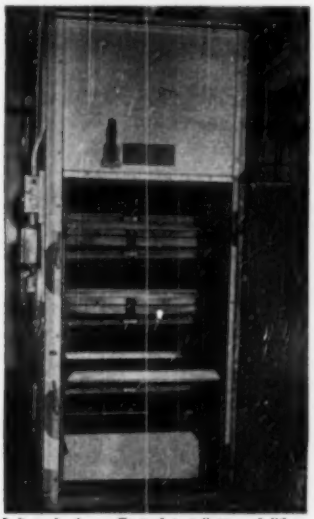


Where the physical characteristics of the product to be dried are such that air can be circulated *through* the bed of material on the tray—the Proctor Thru-Circulation Tray Dryer may be employed to speed processing. By circulating heated air through the bed of material (rather than simply across) more rapid diffusion takes place. This not only speeds drying—but assures the product being uniformly dried all the way through. The circulation is similar to that employed in continuous conveyor drying. The difference is that in the thru-circulation tray dryer, the material remains stationary while in a continuous conveyor system it is carried through the drying chambers. It is obvious, therefore, that the output possible with the thru-circulation tray dryer is greater than with an ordinary cross circulation tray dryer—but not as great as with continuous conveyor drying systems, or even truck-tray systems.

Temperature, humidity and air-circulation can be carefully controlled in these dryers to further govern drying results. The dryers may be furnished with automatic temperature controls for dry bulb only or for wet and dry bulb.

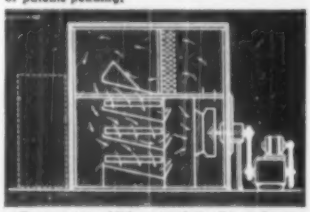
By careful study of your product and output requirements Proctor engineers will be able to determine how well this type of system is suited to your individual needs—and will be able to recommend the size of the system best suited.

When writing for further information—give as complete details as possible about your drying problem to enable Proctor engineers to answer your initial inquiry most intelligently.



Left and above—Typical installation of "thru-circulation" tray dryer.

Much Proctor drying equipment and textile machinery is covered in full or in part by patents or patents pending.



Cross section of "thru-circulation" tray dryer.

PROCTOR & SCHWARTZ





ministrator took accidents into account. The answer is that he practically did not consider them. Out of 186 pages in the book, only one page is devoted exclusively to accidents.

More than that, Mr. Ewing specifically states: "We have not, in these calculations, taken into account the losses occasioned by premature deaths that may reasonably be considered preventable. A man who dies before his time, from a financial viewpoint, has reduced his family's and the Nation's wealth by the loss of his further productive years."

### Disposition of Funds

It is interesting to see how many of the billions of dollars Mr. Ewing wants to spend will be aimed at accident prevention. First of all, the FSA wants to set up a national health insurance scheme. Ewing figures this will be paid for by a payroll tax, similar to the present Social Security taxes. He figures it at 4 percent, or roughly $3,500,000,000. Yes, that is billions. On top of that, he figures that federal, state and local governments should spend an additional $4,100,000,000 in 1960.

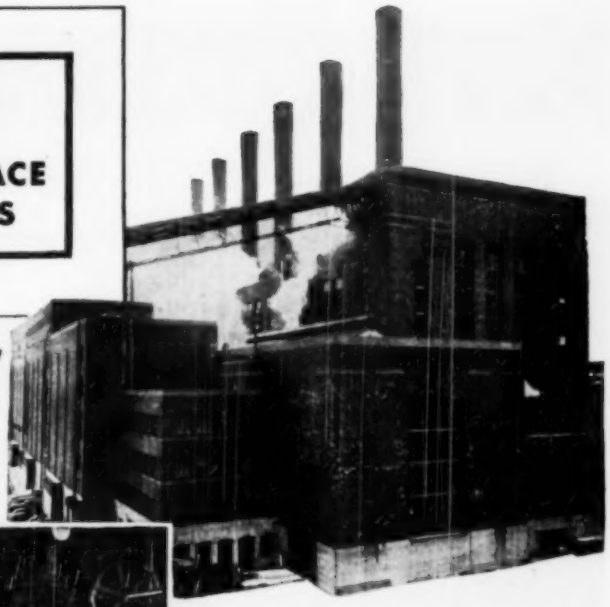
Here then is $7,600,000,000 every year. How much will go for accident prevention? Well, we can't quite tell, because the figure is lumped under what Mr. Ewing calls "community health protection." Here are the things that are lumped into this category: public health service, tuberculosis and venereal disease control, industrial hygiene, mental hygiene, maternal and child health, crippled children programs, abatement of water pollution, rural sanitation facilities, medical care for migratory farm workers, and finally new programs in the fields of dental care, diabetes, nutrition, heart disease, arthritis, rheumatism, and accident prevention. It looks like the total for accident prevention could not possibly be more than $10-20 million.

With all these billions being spent for better national health, we are sorry to see a greater proportion is not earmarked for accident prevention. Safety engineers in plants are doing a good job of cutting the accident rates on the job. They can and should preach accident prevention off the job. But they can touch only a small portion of our population. Safety thinking on the part of the general public must be taught by others as well.

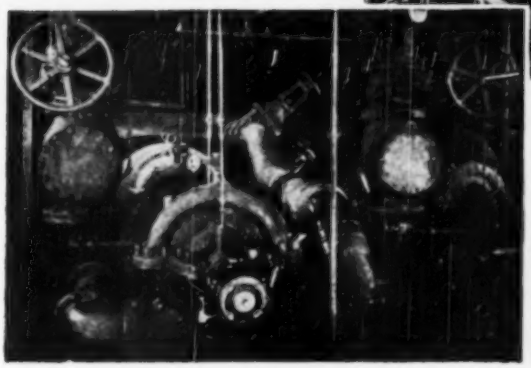
As the good Drs. Dickinson and Welker put it: "Without any effort at all on the part of the medical profession, the 'man on the street' (including the authors and all physicians) can increase the average length of life considerably by the avoidance of unnecessary accidents."

OIC

**SETS THE PACE IN VALVES**



# "MISSISSIPPI MUD" provides proof



*The Union Electric Company, whose plants generate electric energy for distribution to both industrial and domestic consumers in St. Louis, Mo. and adjacent territory, is using OIC Valves extensively in its new 400,000 KW plant at Venice, Ill.*

●

WHEN Union Electric built the first unit of their plant at Venice, Ill., OIC Valves — and others — were used in the pump house during the unwatering of the caisson. These valves were continuously subjected to raw Mississippi River water with its high turbidity and consequent severe scouring action.

The OIC Valves came through with flying colors!

When Union Electric needed additional valves, both for temporary use and for permanent installations, OIC Valves were selected.

Hundreds of similar experiences show why, day by day, OIC is becoming known as "Pace-Setter in Valves"!

## *Check These Pace-Setting Features!*

- Leak-proof joints guard against disastrous pressure-drop.
- Streamlined designs protect flow from turbulence.
- Heavier construction throughout keeps pressures and stresses within safe bounds.
- Wedges of heavy I-beam design provide positive, leak-proof closure, or open the streamlined ports for smooth, even, *free* flow!
- Integral body ribs guide the wedge to its seats with unerring accuracy — effectively reduce vibration and wear.




**Write For Handy OIC Cross Reference Chart — Eliminates Valve Change-Over Problems**

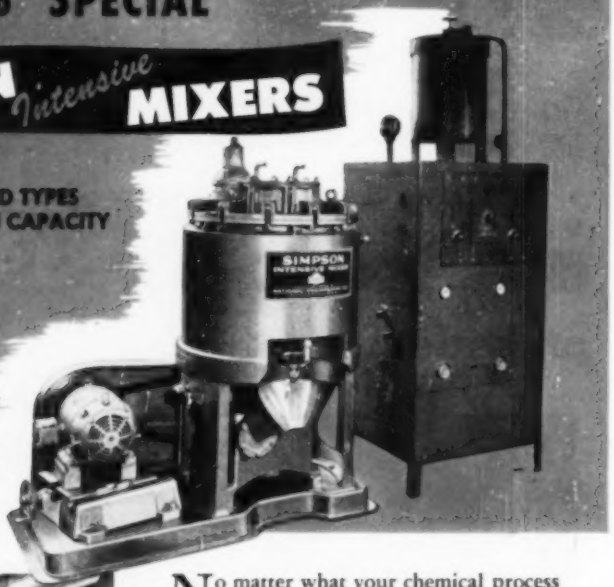
Simply check the number of the valve you wish to replace, look at the chart, and you'll find the right OIC valve. Write to The Ohio Injector Company, Wadsworth, Ohio, for your free copy.

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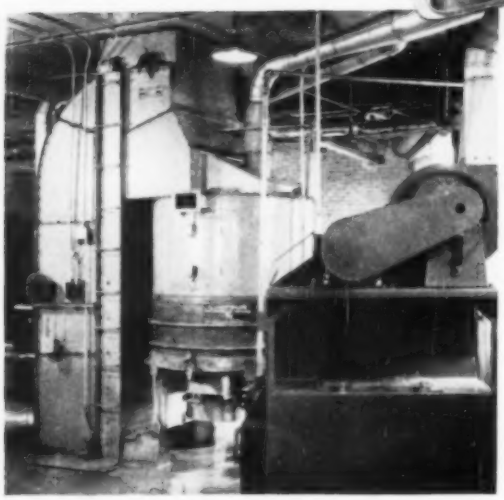
# No Mixing Job Too "SPECIAL" for SIMPSON *Intensive* MIXERS

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*RIGHT:* Specially-designed Simpson Intensive Mixer Model No. 00 built for experimental work at a large chemical plant.

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# CHEMICAL ENGINEERING NEWS

*Richard F. Warren,* ASSISTANT EDITOR

## Chemical Market Research Is Subject Of CMRA-Brooklyn Poly Sessions.

In its second joint meeting with an educational institution, the Chemical Market Research Association held a very comprehensive series of talks on various phases of marketing research as it applied to the chemical industry. Leading off the program was a review of some work in synthetic detergents carried on by R. M. Prather, manager of market research at Indoil Chemical Co. Mr. Prather said that in hard-water areas American housewives are using as much of the new synthetic detergents as they do of packaged soaps. However in some soft water areas detergents amount to only 10 percent of the cleansers used.

Although there were no chemically-produced detergents at all before 1930, Mr. Prather said, the number of brands of these products now on sale numbers over 500, and the total production in this country is 590 million pounds per year, of which more than two-thirds are used in the household.

Dr. W. J. Sparks, director of the chemical division, Standard Oil Development Co., Bayway, N. J., emphasized industry's responsibility to assure the continuity of pioneering scientific research, guided by market research into commercial developments when these become feasible, in order to assure for the public in the future many more such useful new products.

Speaking on "Break-Even Points and Chemical Industries," Prof. R. S. Aries, of the Polytechnic Institute of Brooklyn, said that high production rate is now more essential to this industry's continued profitable operation than before the war. In 1940, he said, the average company had to operate at 50 percent of its productive capacity to avoid loss. Today, because of high wartime and postwar plant investment as well as high labor and materials costs, he added, the average company must operate at 80 percent of capacity to stay out of the red. The long-term investment aspects of the chemical industry are well-defined, Dr. Aries said, as a result of its demonstrated ability to develop new products and new markets.

The all-day meetings, sponsored jointly by the CMRA and the Polytechnic Institute of Brooklyn, were opened by President H. S. Rogers and Dean Raymond E. Kirk of the Institute. Other speakers were Harry Outcault of the St. Joseph Lead Co. discussing market research, Walter J. Murphy, editor of *Chemical and Engineering News*, speaking on published market data, Prof. R. S. Alexander of the School of Business of Columbia University on the use of market research by industrial management, and William Copulsky of R. S. Aries and Associates, Brooklyn, who described the role of the interview in new product development.

R. A. Whitney, President, National Federation of Sales Executives, pointed to the present and future significance of "Market Research in American Distribution," in his talk to the CMRA dinner meeting.

### CCDA Annual Meeting Held in New York

The annual meeting of the Commercial Chemical Development Association was held on March 16, 1949, at the Roosevelt Hotel in New York. A very interesting program was presented under the chairmanship of R. W. Kixmiller, Celanese Corp.

The morning session was devoted to toxicological safeguards in commercial chemical development. Henry F. Smyth, Jr., administrative fellow, Mellon Institute of Industrial Research, gave a paper, "Range Finding Tests—Toxicological Control in New Product Development." The concluding paper of the morning session was given by Louis Schwartz, consulting dermatologist of Washington, D. C., on dermatitis among the public from new fabrics, dyes and finishes.

At luncheon Paul C. Aebersold, chief, isotope division, Atomic Energy Commission, spoke on development of the isotope distribution program in the chemical industry.

The afternoon session covered sales promotion and advertising in commercial chemical development. George Kling, sales manager, chemical division, Atlas Powder Co., presented a technical sales manager's viewpoint. Harlan F. Trumbull, assistant director of research, B. F. Goodrich Co. presented a research director's viewpoint, and Paul Slaughter, vice president, House of J. Hayden Twiss, gave an advertising man's viewpoint.

The technical program was followed by a social hour and dinner, after which Lauren B. Hitchcock, vice president, Quaker Chemical Co. and retiring president of CCDA spoke on putting new chemicals to work.



Alfred T. Loeffler

### SAACI Elects Loeffler President for 1949

New president of the Salesmen's Association of the American Chemical Industry is Alfred T. Loeffler, Monsanto Chemical Co. Other officers are: vice president, Charles V. Douglas, Heyden Chemical Corp.; treasurer, Paul W. Hiller, Innis, Speiden & Co.; secretary, Edward A. Bush, Bush

Aromatics, Inc. Board of directors includes: Harold C. Green, L. Sonneborn Sons; Robert L. Hutchins, Commercial Solvents Corp.; Leon W. Miller, Barrett division, Allied Chemical & Dye Corp.; Robert J. Milano, Millmaster Chemical Co.; George W. Poland, Jr., Stauffer Chemical Co.; William J. Weed, Niagara Alkali Co. Ex-officio member is retiring president James G. Park, Enjay Co., Inc.

### Conservation Is Theme of Houston Meeting

CONSERVATION of Natural Resources will be the theme of the Second Annual Symposium of the Engineers' Council of Houston to be held at Houston, Tex. on April 2. Scheduled papers include "Conservation of Water," by Paul Weaver, president, American Association of Petroleum Geologists; "Conservation of Soil," by W. A. Albrecht, Dept. of Soils, University of Missouri; "Conservation of Major Sources of Energy," by Eugene Ayres, Gulf Research and Development Co.; "Conservation of Character of Man," by S. L. Joekel, Austin Presbyterian Theological Seminary; and "Conservation of Man," by Louis Bromfield, Lucas, Ohio.

The program includes a luncheon and dinner. Reservations may be made through Dean F. Saurenman, Baker Oil Tools, P. O. Box 3048, Houston, Tex.

### Wigton-Abbott Gives Progress Report

A CONSTRUCTION record of more than 1,000 buildings and plants since January 1924, representing a cost well in excess of $250,000,000, is the contribution of the Wigton-Abbott Corp. to American industry, it was revealed as the organization celebrated its twenty-fifth anniversary.

Since the end of hostilities, Wigton-Abbott along with other construction firms has been extremely active in the vast move to rehabilitate, modernize and expand America's industrial plant. Some of the organization's larger post-war projects include research laboratories for the Celanese Corp. of America and the Air Reduction Co. at Summit and Murray Hill, N. J., respectively, the new gutta percha processing plant of the L. A. Dreyfus Co. at Oak Tree, N. J., a tar-stripping plant for the Barrett division of Allied Chemical & Dye Corp. in Pittsburgh, Pa., an asphalt processing plant for Witco Chemical Co. at Perth Amboy, N. J., a raw trona ore processing plant at Westvaco, Wyo., for the Westvaco Chemical division of the Food Machinery Corp., and an office building at Parlin, N. J., for E. I. du Pont de Nemours & Co., Inc.

Other recently completed projects include plants for the General Chemical division and Barrett division of Allied Chemical & Dye Corp. at Newell, Pa., and Ironton, Ohio, respectively and four industrial structures for the Hercules Powder Co. at Kenvil, N. J.

At the present time Wigton-Abbott jobs under way include a chemical plant for the General Chemical division of Allied Chemical & Dye Corp. at Baton Rouge, La.

Heading the construction firm are C. Benson Wigton, president, and E. P. Abbott, vice president. Other officers are H. G. Buel, vice president, F. Guy Rutan, secretary, and J. B. Cochran, comptroller.

### Cyanamid Sets up New Product Development Unit

A NEW PRODUCT development department has been formed by American Cyanamid Co. This department, with George W. Russell as manager, will report directly to the company's vice president in charge of research and development.

One of the functions of the new department will be to determine whether there are economic uses for selected products which have been developed in Cyanamid's research laboratories, for which sales applications are not yet established. At present, most of the group's activity will be devoted to the evaluation of organic nitrogen compounds, although eventually the entire range of American Cyanamid's products will be included.

In addition to market development, the group will conduct market research on currently manufactured products, as well as those in the development stage.

### Mathieson Buys Southern Acid In Expansion Move

MATHIESON CHEMICAL CORP. has announced it has purchased the business and assets of Southern Acid & Sulphur Co. and is distributing 265,000 shares of its (Mathieson's) authorized but unissued common stock to the common stockholders of Southern Acid & Sulphur.

The purchase brings to Mathieson the seven plants of Southern Acid & Sulphur in the Southwest. These plants are at the following locations and produce the following products: Houston, Tex., superphosphate, ammonium sulphate, ammonium phosphate-sulphate (16-20-0), sulphuric acid and ground and refined sulphurs; Beaumont, Tex., sulphuric acid; Port Arthur, Tex., sulphuric acid; Shreveport, La., sulphuric acid; Little Rock, Ark., superphosphate, mixed fertilizers, ammonium sulphate and sulphuric acid; McKamie, Ark., sulphur from "sour" natural gas; Macedonia, Ark., sulphur from sour gas.

Mathieson has not yet announced specific plans to tie in its own operations with those of Southern Acid. At Lake Charles, La., Mathieson opened in 1934 the Mathieson Alkali Works, which is now manufacturing caustic soda (ammonia-soda process) and light and dense soda ash. The plant formerly manufactured salt cake also, but is not making it at present.

Also at Lake Charles, Mathieson operated a government-owned synthetic ammonia plant and ammonia oxidation facilities during the war and bought the entire plant in 1948 for $7 million. The plant is now producing ammonia. It has been understood that Mathieson plans to manufacture ammonia derivatives there.

### Leavitt Elected President By Perfumers

JAMES T. LEAVITT, vice president of the Central Solvents & Chemical Co., is the new president of the Chicago Perfumery, Soap & Extract Association. Other newly elected officers are: W. F. Kammerer, George Leuders & Co., vice president; C. E. Arch, New England Collapsible Tube Co., secretary; and J. C. Browning, Hydrosol, Inc., treasurer.

### Freeport Sulphur Completes Louisiana Expansion

FREEPORT SULPHUR CO. has completed a $7 million expansion program at its Grande Ecaille, La., mine. The company is also engaged in developing its crude petroleum production properties in St. Martin Parish, La.

At Grande Ecaille, Freeport has enlarged its power plant, water-treating plant, mechanical shops, pipeline and loading systems. New facilities have been added, including a materials handling terminal and a marine shop. The expansion has made possible the drilling and operation of additional sulphur wells and the handling and loading of the increased output. The company's other sulphur mine is

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# FILTERS

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- Clarification of industrial acids and corrosive liquids.
- Continuous Flow or batch operation.
- Removal of solids from liquids where the reclamation of the cake is not essential.

*WITH*

## PORO-STONE

*AND*

## PORO-CARBON

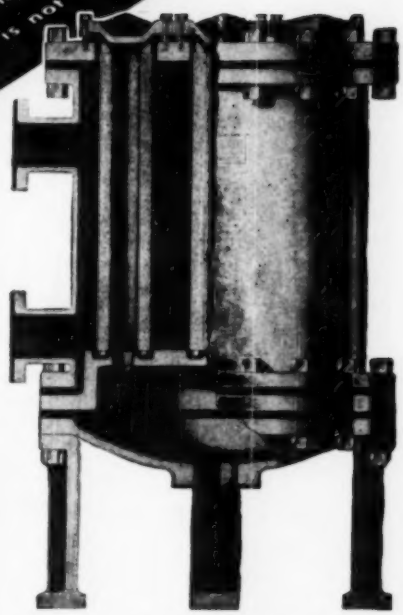
### *FILTER MEDIUM*

***INERT...*** Resists action of acids and alkalies.

***PERMANENT...*** Eliminates filter medium replacement.

***RIGID...*** Permits pressure filtering and backwashing.

***HIGH DEGREE FILTRATION...*** Obtainable in various porosities.



**TYPE CFL and CFR**

1. **Totally enclosed.** Especially safe for handling hazardous liquids, as dismantling for cleaning is not necessary.
2. **Cleaned by Backwashing...** the Adams *surge tank* method. Filtered liquid under pressure is forced through the filter in reverse flow, thoroughly cleaning the pores in a few seconds.
3. **Complete Liquid Recovery.** Valuable liquids filtered completely and withdrawn before backwashing.
4. **All contact surfaces lined** to resist action of corrosive liquid.

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**207 EAST PARK DRIVE**
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REPRESENTATIVES IN PRINCIPAL CITIES OF UNITED STATES AND CANADA




the Hoskins Mound unit near Freeport, Tex.

Freeport has recently completed three producing oil wells in St. Martin Parish, and each is producing at the maximum daily allowable. Three or four additional wells may be drilled soon.

### Soap and Glycerine Producers Discuss Detergents

At a recent meeting of the Association of Soap and Glycerine Manufacturers, H. E. Bramston-Cook of Oronite Chemical Co. discussed the future status of detergents. He said that two years ago it was estimated that the sales volume of synthetic detergents was about 250 million pounds per year. Sales of synthetic detergents by Association members totaled 402 million pounds in 1948, an increase of 152 million pounds or 60 percent in two years by Association members alone.

It is not to be expected that this expansion will be maintained indefinitely, since rational limitations will be imposed (a) by consumer prefer-

### CONVENTION CALENDAR

American Chemical Society, 115th national meeting, San Francisco, Calif., March 27-April 1.

American Society of Brewing Chemists, annual meeting, Roosevelt Hotel, New Orleans, April 10-14.

American Institute of Electrical Engineers, conference on industrial application of electron tubes, Statler Hotel, Buffalo, April 11-12.

National Association of Corrosion Engineers, annual conference and exhibition, Netherlands-Plaza Hotel, Cincinnati, April 11-14.

American Ceramics Society, national meeting, Netherlands-Plaza Hotel, Cincinnati, April 24-28.

Electrochemical Society, spring meeting, Benjamin Franklin Hotel, Philadelphia, Pa., May 4-7.

American Institute of Chemical Engineers, regional meetings, Tulsa, May 8-12.

American Oil Chemists Society, annual meeting Hotel Roosevelt, New Orleans, May 9-10.

Instrument Society of America, spring meeting, Royal York Hotel, Toronto, May 12-13.

Society for Experimental Stress Analysis, spring meeting, Hotel Statler, Detroit, May 19-21.

Manufacturing Chemists Association, annual meeting, Skytop, Pa., June 2.

Packaging Institute, annual forum, Commodore Hotel, New York, October 24-26.

22nd Exposition of Chemical Industries, Grand Central Palace, New York, November 28-December 3.




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# Union Multiwall Specialist

**(His job is to make your packaging dollar go further)**

YOUR UNION Multiwall Specialist knows how to tailor a package to meet the specific needs of your product and method of distribution. He has helped many firms reduce their packaging costs. He may be able to do the same for you.

Union Multiwall Bags are used in plants making more than 300 different commodities. They're speeding up packaging, cutting labor and shipping costs, giving added protection to the product—yes, and making customers happier.

Even if you're now using Multiwall Bags the Union Multiwall representative who calls on you can give you new ideas on packaging methods that may save you money. For he is backed by the specialized packaging knowledge of America's largest maker of paper bags—with its own forests, the largest completely integrated Kraft pulp-to-bag plant in the world, and skilled engineering and design experts.

Let him show you how Union resources and packaging experience can help you.

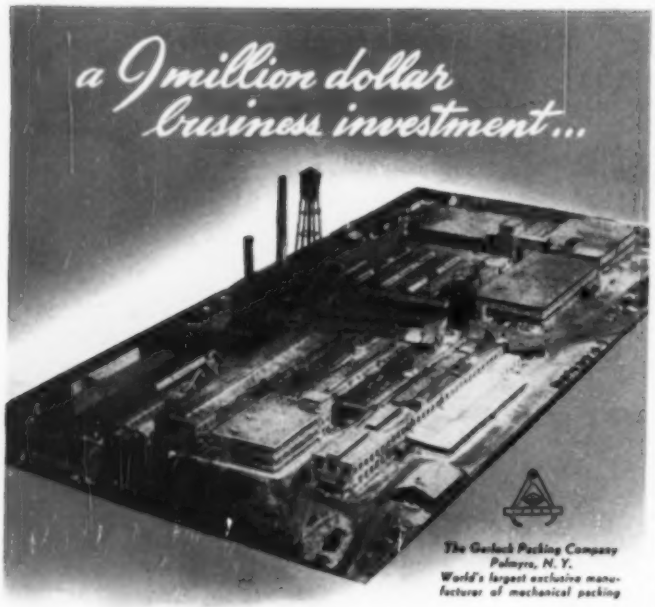



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**UNION BAG & PAPER CORPORATION**

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...*"Automatic" Sprinkler* protected, of course!

It's not surprising that many leading manufacturers, like The Garlock Packing Company, for example, have found that fire protection by *Automatic Sprinkler* earns dividends in dollars as well as in safety. The first buildings of this multi-structure facility were sprinklered back in 1923 and the initial cost of installation has long since been amortized. Subsequent new construction has also come under the vigilance of *Automatic Sprinkler* protection. *an investment in safety that can't be beat.*

Like Garlock, your business too, is in a position to realize the money saving advantages of fire protection by *Automatic Sprinkler*, and you'll find the following facts worth keeping in mind:

1. Over a half century of background in the design, manufacture, engineering, installation and maintenance of all types of sprinkler equipments, qualifies *Automatic Sprinkler's* leadership in the science of fire protection.
2. *Automatic Sprinkler* devices and systems are designed to the individual requirements of business, commercial and industrial alike, and are approved by all leading insurance authorities.
3. *"Talking over"* the safety and investment advantages of *Automatic Sprinklers* involves no obligation on your part and surveys and estimates are cheerfully furnished without cost or obligation.



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Hospitals - Institutions
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provides positive protection for severe fire hazards

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
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FOR INVESTMENT PROTECTION
DEVELOPMENT - ENGINEERING MANUFACTURE - INSTALLATION
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA


ence for soap, particularly in the case of heavy duty uses, in soft water areas, and (b) the economic pressure of low fat prices in the realm of heavy duty synthetics vs. built soap. Cost reduction, coupled with improved heavy duty detergency, can be accomplished with lower active ingredients content synthetics by reformulation based upon builders and auxiliaries now available. Further, price reductions in the basic hydrocarbons used in synthetics have occurred in the past two and one-half years, the high point for the product sold in the largest volume being 32 c. per lb., fob. refinery, the low point being 16¼ c., the equivalent of the present market price on a fob. refinery basis. A policy of continuing price reduction until a low stable level is reached was forecast in 1946. In line with this, further reductions may be expected.

The rate of sale of synthetic detergents, based upon sales by Association members, increased steadily during 1948, from 69 million pounds in the first quarter to 120 million pounds in the fourth quarter, while hard soap sales declined from a quarterly average of 646 million pounds in the first nine months to 545 million.

He pointed out that sale of synthetic detergents in 1948 exceeded 525 million pounds. Expansion of this volume is anticipated in 1949, with sales estimated at 675 million pounds. It is believed that a level of one billion pounds per year will be attained by 1952.

Other speakers on the synthetic detergent panel were: Lee D. Callans, General Aniline & Film Corp.; Lawrence H. Flett, National Aniline division; and J. C. Harris, Monsanto Chemical Co.

## Shell Spending $24 Million On Petroleum Research

THE VARIOUS Shell organizations have a total budget of $24 million this year to finance research in the United States and foreign countries. The research work will cover all phases of the Shell network beginning with the exploration for and production of crude oil and natural gas and extending through petroleum refining and manufacture of chemicals. Much of the total will be spent in broad research programs of Shell Development Co. at Emeryville, Calif.

Stress will be laid on aviation fuels and agricultural chemicals, says H. S. M. Burns, president of Shell Oil Co. Burns says the development of jet-powered aircraft makes the study of fuels imperative.

Shell is giving top priority to agricultural chemicals in view of the in-

# Need Stainless Steel?

# TRY US FIRST



IT's always wise to "Try Us First" when you need stainless steel. For it's a fact that *U·S·S* Stainless Steel is "tops" in quality, dependability and proven excellence.

Right now our stocks include No. 2B Finish Sheets "par excellence"; No. 4 Finish Sheets of uniform quality. Also bars, meeting high standards of machinability; plates up to 120″ wide and 360″ long . . . as well as welded and seamless tubing, pipe, angles, channels, welding electrodes in all standard grades and specifications are on hand for your needs.

So contact our nearest warehouse or sales office. You'll get prompt, courteous service. Meanwhile, why not fill in and return the convenient coupon for our free booklets on U·S·S Stainless Steel? Do it now.

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**Symbol of Service for Steel Users**

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Without obligation on our part, please send us FREE booklets on U·S·S Stainless Steel as checked below:

☐ Introduction to Stainless Steel ☐ Fabrication of Stainless Steel

Title.....

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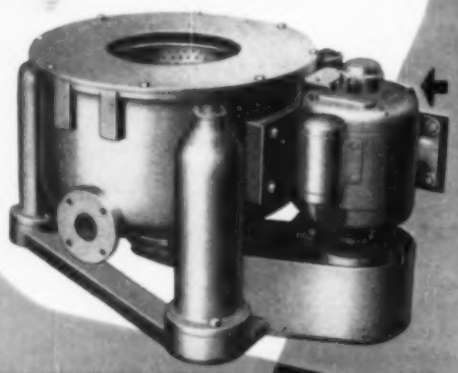
## UNITED STATES STEEL SUPPLY COMPANY

Warehouses: BALTIMORE · BOSTON · CHICAGO
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FOR LABORATORIES, PILOT PLANTS
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TOLHURST
LABORATORY
CENTRIFUGALS



DO THESE 6 JOBS
FASTER
MORE ECONOMICALLY

- FILTERING
- DRAINING
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- CLARIFYING
- THICKENING
- SEPARATING

LABORATORIES AND PILOT PLANTS having small batches of chemicals or pharmaceuticals to extract find Tolhurst "Center-Slung" Laboratory Centrifugals practical, economical and ideally suited to this purpose. These small but efficient models save floor space, time, labor and cost.

Tolhurst Laboratory Centrifugals have adjustable, variable speeds. Basket is 12" in diameter and can be constructed of stainless steel, monel, bronze or steel rubber covered. Cases may be jacketed for circulation of coolant or steam.

LABORATORY SERVICE AVAILABLE — For confidential, unbiased and intelligent recommendations on your centrifugal problems, consult Tolhurst with its well-qualified staff and modern research facilities.

WRITE FOR PRICES AND CATALOG complete with illustrations, dimensions and specifications on all Tolhurst Centrifugals.

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Division of American Machine and Metals, Inc.
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creasing demands on the world's food supplies. At Modesto, Calif., center of Shell's food studies, research is going forward in oil-derived chemicals including those used for insecticides, fungicides, fertilizers and weed killers.

At Wood River, Ill., Houston, Tex., and Wilmington and Martinez, Calif., Shell is working on the improvement of petroleum products and their application to new uses. At Houston, Shell Chemical Corp. has substantially completed its large postwar expansion program.

### New Census Reports Now Appearing

PRELIMINARY results of Census of Manufactures 1947 are being issued currently by Bureau of the Census. Press releases are being issued as rapidly as the first national summaries of production data can be compiled. Complete returns will be many months later in appearance, especially the breakdown of detail of commodities and the summarization by states. Some of the more elaborate industries like inorganic chemicals and organic chemicals will also be delayed because of the great detail necessary in statistical compilation.

### Underground Coal Gasification Resumed in Alabama

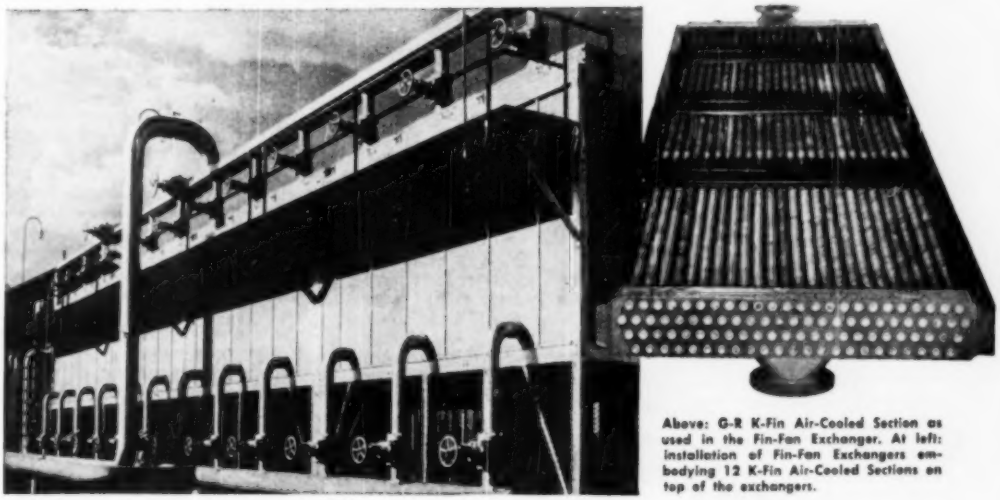
DURING mid-February U. S. Bureau of Mines exhibited to visitors the underground workings where gasification of coal in place in the mine is now under way. This is a resumption of a test by the Bureau on land of Alabama Power Co. near Gadsden.

In this case the Bureau has blocked off with concrete walls a much deeper section of the coal bed. Early tests reported in *Chem. Eng.* two years ago were somewhat inconclusive because the bed then fired was so near the surface as to preclude the control of products generated during firing. It is hoped that the present experiment may give more conclusive data as to the quantity of products which may be recovered by this technique.

### Flameproofing Project Established at Columbia

A PROJECT for the study of fundamental principles of flameproofing has been established in the department of chemical engineering at Columbia University, jointly by the Textile Section of the Quartermaster Corps and the Office of Naval Research of the Navy Department. During World War II a similar war research project,

# Now you can **condense steam** or **cool liquids** and **gases** by **AIR** in the **FIN-FAN EXCHANGER**



Above: G-R K-Fin Air-Cooled Section as used in the Fin-Fan Exchanger. At left: installation of Fin-Fan Exchangers embodying 12 K-Fin Air-Cooled Sections on top of the exchangers.

At last! . . . a compact, effective, dependable, all-weather *air cooled* condenser and cooler that eliminates the complications, expenses and troubles of water cooling equipment.

The "package-type" self-contained FIN-FAN Exchanger comes to you as a complete unit, ready for erection. It is strongly designed for high pressures and temperatures, can be installed in limited space within a building, on the ground, or on a roof, and it operates with *forced draft*, independent of the direction or intensity of air currents.

This advantageous unit is being used for condensing exhaust steam and refrigeration systems, and for cooling oil, water, process liquids and gases in installations all over the country. Its G-R K-Fin elements with helical fins have proven their superior effectiveness and durability in many thousands of cooling and condensing units; and its fan, fan drive and structure are expressly designed by Fluor Corporation Ltd., who are associated with The Griscom-Russell Co. in the development of these units.

Write for Bulletin 1231 describing the Fin-Fan Exchanger in detail.

GR-210

THE GRISCOM-RUSSELL CO., 205 MADISON AVENUE, NEW YORK 17, N. Y.

**GRISCOM-RUSSELL**

PIONEERS IN HEAT TRANSFER APPARATUS

Quickly dismantled!
Easily assembled!

MORRIS TYPE R SLURRY PUMP

Simple impeller adjustment
assures minimum lay-up time



● The design of the Morris Type R is simplicity itself. And simplicity in a pump means longer uninterrupted service . . . lower maintenance . . . better performance under tough operating conditions.

● To dismantle, you merely remove four bolts. Take off the end cover . . . and there's the impeller. *You don't have to disturb the piping.*

● Four adjusting screws close the worn clearances on the suction side of the impeller. This adjustment moves the entire rotating assembly as a unit, including impeller shaft, bearing and bearing housing.

● Since the Morris Type R takes its suction from the drive side only, the packing is subjected to suction or positive head pressures only. Stuffing box is not nearly as vulnerable to entrance of solids.

● Morris 83 years' experience in pump building is your best assurance of dependable service from the Type R Slurry Pump.

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
Branch Offices in Principal Cities

MORRIS Centrifugal Pumps


under the sponsorship of the Quartermaster Corps, was maintained at Columbia for a study of improved methods for flameproofing and, as a result of some of the work of the earlier project, it has been decided to make a more thorough investigation of the various mechanisms whereby certain fire retardant chemicals prevent the combustion of cellulose and other types of textile fibers.

Two positions as research assistants are available in the department of chemical engineering at Columbia, under this project, which will permit credit for the research under the project to be acceptable for the requirements of the Ph.D. degree.

### AIChE Holds Regional Meeting at Los Angeles

This month the American Institute of Chemical Engineers held its spring regional meeting in Los Angeles, Calif. The meeting ran from March 6 to 9, and included six technical sessions at which symposiums on jet combustion, catalytic cracking and bubble plate phenomena were held. In 25 technical papers that were presented, the subjects of heat transfer, submerged combustion, diffusion of multi-component gases, ejector performance, combustion in rocket motors, catalytic cracking, ion exchange, filtration, $SO_2$ absorption in water, and plate efficiencies in extractive distillation were discussed.

In addition to the wide variety of technical subjects covered in these papers there were eight scheduled plant trips. Among those on the agenda were tours of the harbor area, Shell Chemical's Dominquez plant, Standard of California's butadiene operations at El Segundo, and Dow's styrene plant.

### Materials Handling Institute Elects Officers

J. H. W. Conklin, Clark Equipment Co., was elected president of the Materials Handling Institute at the annual election of officers held in Philadelphia on the last day of the recent National Materials Handling Exposition. He succeeded S. W. Gibb, Yale & Towne Manufacturing Co. sales manager. Other officers elected for 1949 are: first vice president, J. G. Bucuss, Acme Steel Co.; second vice president, J. P. Lawrence, American MonoRail Co.; secretary-treasurer, R. Kennedy Hanson.

Elected to the board of directors were: L. C. Backart, the Rapid-Standard Co., Inc.; G. J. Berry, the Electric

# ELECTROSTATIC COATINGS PREHEATED FOR CLOSER EVAPORATION CONTROL

Harper J. Ransburg's Electrostatic Spray Process is rapidly becoming a widely accepted method of mass production coating. Throughout the country, companies using this "super paint brush" find that they save up to 75% in paint, up to 94% in labor—and get a more uniform film thickness that improves appearance and increases wearability.

In shifting from hand spraying to the fully automatic Ransburg process, it was found that thinners with slower evaporation rates had to be used. With baking enamels, various combinations of Solvesso Xylol, Solvesso 100 and Solvesso 150 were used depending on the finish desired or even varying with the weather.

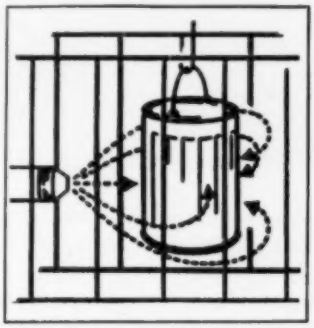


Ranges, metal cabinets and numerous kitchen appliances are among the many items now being coated by the new electrostatic spray process.

### *Solvesso 100 Used in New Preheated Coatings*

To avoid changing the composition of thinner according to marked changes in atmospheric conditions and to increase the film thickness per coat, the new preheating method was developed. In this method, the coating is preheated to 190°F. and a single solvent, Solvesso 100, is used. This method provides a closer control of evaporation rate and an even higher quality of finished product is assured.

Solvesso 100 is only one of many Esso Solvents that are serving in such industries as textiles, seed oil extraction, rubber, printing, leather, etc.—wherever uniformity and high quality are required. Esso Petroleum Solvents are available in a wide choice of evaporation rates and boiling points. If you have a solvents problem in your business, our nearest sales office will be glad to supply any technical information or assistance you may need. Write us today.



Spraying in electrostatic field causes paint particles to "wrap around" article, reversing direction as much as 180°, almost completely utilizing coating material.

## ESSO HEPTANE YIELDS HIGH PROTEIN TANKAGE IN FAT RENDERING

With the fat rendering industry rapidly shifting to the solvent extraction method, there has been a marked increase in the use of Heptane, one of Esso's new close-cut solvents. With an initial boiling point of 205°F., Esso Heptane offers a rapid and uniform stripping rate, less retention of solvent and less residual odor.

Esso Heptane's narrow boiling range (7-15°F.) increases the yield of tallow and can reduce the fat content of the residue from about 11% to below 1% thereby increasing its protein content. (Common practice, however, is to stop at 3% residual fat). Called tankage, this residue is sold to feed, fertilizer and dog food manufacturers at a price in direct ratio to its protein content.

Esso

## PETROLEUM SOLVENTS

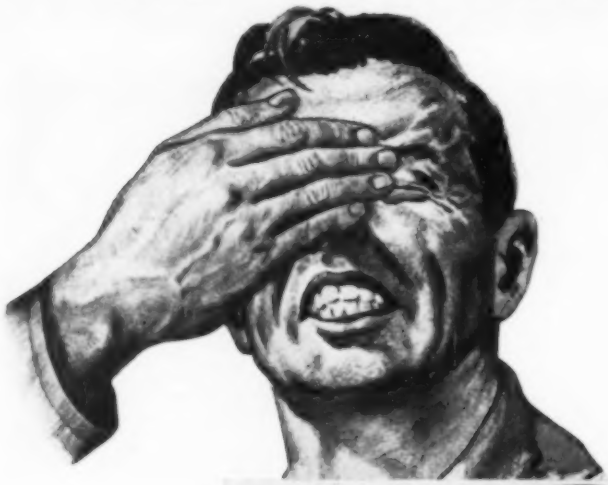
Sold in: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

**ESSO STANDARD OIL COMPANY**—Boston, Mass.—New York, N. Y.—Elizabeth, N. J.—Baltimore, Md.—Richmond, Va.—Charleston, West Va.—Charlotte, N. C.—Columbia, S. C.—Memphis, Tenn.—Little Rock, Ark.—New Orleans, La.

**ESSO STANDARD OIL COMPANY OF PENNSYLVANIA**—Philadelphia, Pa.

# He didn't forget . . .

## He just took a chance!



When workers risk their eyes, with disastrous results to both themselves and the company alike, it's time to look into the cause of unsafe practices.



Goggle Style TAW51

WILLSON answers the problem of getting safety equipment worn by designing the utmost comfort into their entire line of eye and respiratory protective devices. The goggles illustrated have eyecups that are molded to fit the bony structure around the eyes. The chain bridge and elastic headband are adjustable for comfortable fit. And the Super-Tough* lenses meet or exceed Federal Specifications for optical clarity as well as impact resistance.




**DAILY REMINDERS**

*Such as Willson "Blind Man" Safety Posters keep workers aware of the need for wearing goggles. Supplies available on request.*

WILLSON®

"Established 1870"

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WILLSON PRODUCTS, INC., 223 WASHINGTON STREET, READING, PENNA.




Products Co.; E. C. Hamm, Service Caster & Truck Corp.; W. A. Meddick, the Elwell-Parker Electric Co.; G. G. Raymond, Lyon-Raymond Corp.; W. G. Reycroft, the Bassick Co.; F. F. Seaman, Robbins & Myers, Inc.; L. West Shea, the Union Metal Mfg. Co.; W. C. Stuebing, Lift Trucks, Inc., and Messrs. Conklin and Bucuss.

### Pollution Control Offices Opened Through Country

PUBLIC Health Service has announced a complete set of offices for the water pollution control units in each important drainage basin of the United States. There will be 14 of the stations where the survey responsibility of Federal Security Agency and its Public Health Service will be set up. For the engineering aspects of corrective measures and corrective measures to be reviewed for loans, Federal Works Agency has established its nine regional offices of Bureau of Community Facilities. They will aid in preparation of pollution control plans and pass on any loans for programs of construction which may be entitled to Federal aid.

Industry executives seeking information should communicate with either or both of these government organizations: Public Health Service, Washington 25, D. C., or Bureau of Community Facilities, Federal Works Agency, Washington 25, D. C.

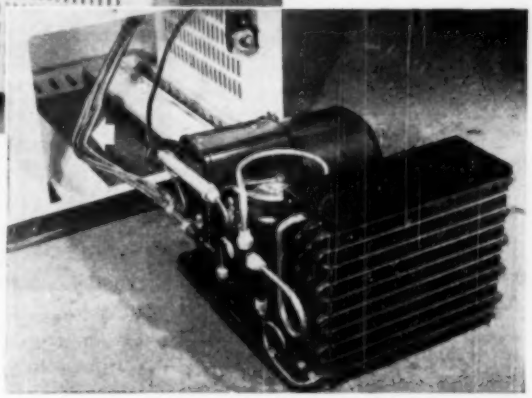
Incidentally, the government is finding difficulty in securing an adequate number of qualified technical personnel to aid in carrying out the program. Public Health Service is particularly anxious to add to its investigation corps qualified sanitary engineers, chemists, biologists, and bacteriologists. Positions open range up to about $7,500 or $8,500 according to the branch of the service and the experience of the applicant seeking a place in the commissioned corps of PHS.

### Whiskey Inquiry Denied By Tariff Commission

FURTHER tariff curtailments are coming. Small, but important, evidence of this was the denial by U. S. Tariff Commission of the formal request of the whiskey-making industry that threatened large imports be investigated. The Commission bluntly denied that request.

Active since December, Commission proceedings are leading toward far more extensive trade agreement curtailment of statutory import duties. Beginning January 25 were the second hearings regarding prospective





Here's the Penguin 40 gallon ice cream dispenser, made by Penguin Freezer Cabinet Corp., New York City. Inset shows condenser unit removed for service, yet refrigerant lines are (see arrow) completely connected, thanks to American Seamless.

# AMERICAN SEAMLESS FLEXIBLE METAL TUBING gives Freezer Cabinets "pull-out" service feature

INSTANT ACCESSIBILITY is an important feature of Penguin Freezer Cabinets for farm, home and commercial use.

By using highly flexible American Seamless for refrigerant lines, the entire refrigerating unit slides out on a track for inspection or service without disconnecting.

Furnished complete with standard couplings, these reliable connectors are made from seamless bronze tubing, corrugated for flexibility, and covered with wire braid for added strength and prevention of elongation under pressure. This tubing is 100% tight, one-piece construction, rust and corrosion-resistant.

Have you a problem in conveying steam, oil, water, other liquids, semi-solids or gases . . . in eliminating vibration, overcoming misalignment, connecting moving parts or getting piping into cramped spaces? Experienced American engineers are at your service, ready to recommend the best American Flexible Metal Assembly to fit your particular needs.

Write for literature and feel free to consult our Engineering Department at any time.

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**THE AMERICAN BRASS COMPANY**

***American Metal Hose Branch***

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*Subsidiary of Anaconda Copper Mining Company*

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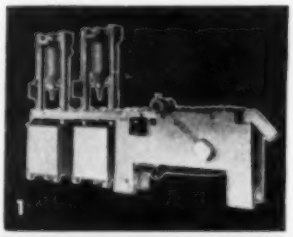
# THE S&S LINE

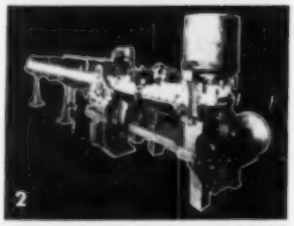
## FOR BETTER PACKAGING

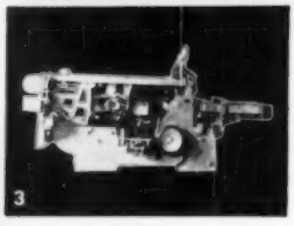
Whether your product goes to the consumer in bottles or cans, odd shapes, boxes or bags, there's an S & S packaging machine with speeds to suit your needs.

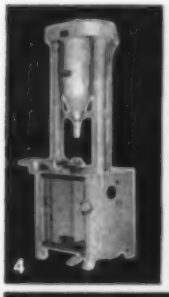
Our Engineering staff is always available to help in the solution of your packaging and filling problems.

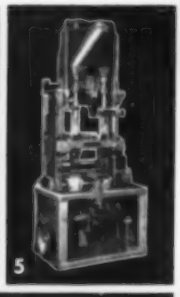
*Write for further information*


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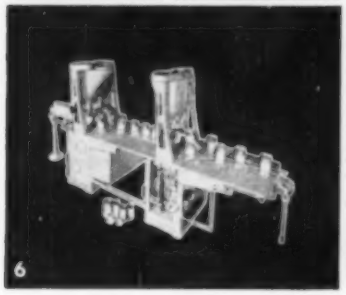

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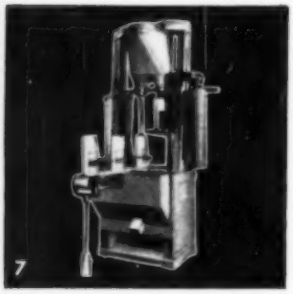

3


4


5

1. Bag & Envelope Sealer
2. Neverstop Carton Filler & Sealer
3. Automatic Tight Wrapper
4. Universal Filler
5. Stokeswrap Packaging Machine
6. Automatic Double Unit Filler
7. Duplex Packer & Weigher


6


7

STOKES & SMITH Co

PACKAGING MACHINERY — PAPER BOX MACHINERY

*(A wholly owned)*

*Subsidiary of Food Machinery and Chemical Corporation*

**4914 Summerdale Ave., Philadelphia 24, U. S. A.**


cuts in rates for 11 countries for which trade agreements were not previously under discussion. The list of commodities involved was as usual announced in the Federal Register (Dec. 18, p. 7872).

### Westvaco Plans Second Phosphorus Furnace

LAST YEAR Westvaco Chemical Corp. (now a division of Food Machinery & Chemical Corp.) announced plans to construct an electric furnace to manufacture elemental phosphorus at Pocatello, Idaho. Under an agreement with Simplot Fertilizer Co., Westvaco is to use lowgrade phosphatic shales from deposits at Fort Hall; Simplot will continue to make phosphate fertilizer from underlying high-grade rock. Work on the $4,000,000 Westvaco project started last July; completion is expected this April. A spur track linking rock pits with the two plants has already been completed.

Last month, even before completion of the initial unit, Westvaco told about its plans for a second phosphorous furnace at Pocatello. Cost is estimated at $2,000,000; daily capacity will be about 30 tons. Engineering is already under way, and building materials and equipment are being placed on order for the new unit. Construction will begin as soon as the first unit is finished.

### Dow Sells Stock To Employees

EMPLOYEES of the Dow Chemical Co. subscribed to 48,500 shares of the company's common stock under a recent payroll deduction purchase plan.

Dow officials said they were well pleased with the response to the plan, which was designed to encourage broader employee ownership, and pointed out that subscriptions amounted to approximately 4 percent of the total company payroll. About 22 percent, or 3,300, of the 15,000 eligible employees participated and all eligible divisions and subsidiaries were represented.

The stock was offered at a price of $44.31 per share. This was $2.56 below the closing market price on December 6, the final subscription date, the company said.

Subscriptions under the Dow plan are payable over a 12-month period, but employees have the option of completing payment, cancelling or reducing their subscriptions at any time during that period.

"There is, of course, no suitable yardstick for determining the success



# With the Southern Cotton Oil Company, too . . . It's MONEL for handling $H_2SO_4$ and fatty acids

*Approximately 60,000 pounds of 0.125" sheet Monel was used to fabricate these 12 self-supporting, fat splitting tanks at the Southern Cotton Oil Company's Savannah, Ga. plant. A similar installation was erected at this company's Gretna, La. plant.*

• • •

RECENTLY, the Southern Cotton Oil Company erected 24 large self-supporting, fat splitting tanks—12 at their Savannah, Ga. plant, and 12 at their Gretna, La. plant.

Based on its outstanding service record in fat splitting operations, Monel* was chosen.

In addition to being highly resistant to hot corrosives encountered in Twitchell splitting, vessels made of Monel do not introduce undesirable metallic contamination . . . an important consideration with today's exacting standards of product purity.

As a fabricating material, Monel offers important mechanical advantages, too. It is stronger than structural steel, hard, tough, yet ductile enough to permit easy forming and machining. Monel can be joined by soldering, brazing, or welding, and welds in Monel are as corrosion-resistant as the alloy itself.

Prominent manufacturers of stearic acid, red oil, glycerine and allied chemicals have reported service records *up to eleven years* for Monel tanks and heating coils.

For further information about the applications of INCO Nickel Alloys in chemical processing, write for: *"Resistance of Inconel, Nickel, Monel, and Ni-Resist to Corrosion by Fatty Acids."*

Meanwhile, if you have metal selection problems involving product contamination, heat resistance, or corrosion resistance, why not consult our Technical Service Department?

**THE INTERNATIONAL NICKEL COMPANY, INC.**
***67 Wall Street, New York 5, N. Y.***

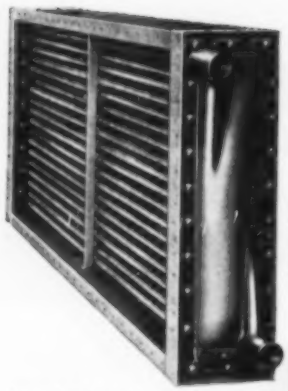
*Reg. U. S. Pat. Off.

EMBLEM OF SERVICE
INCO
TRADE MARK

# MONEL...for Minimum Maintenance

Figure it at

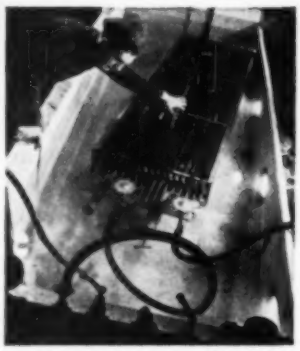
100% FULL RATING



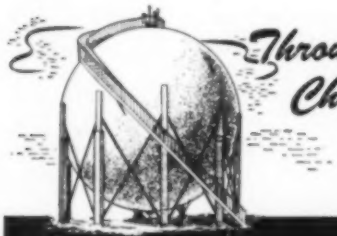
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Aerofin's continued research has developed accurate ratings that are good for the life of the unit. You can always count on Aerofin to deliver full-rated capacity – full efficiency.

Over 25 years' experience, combined with unequalled production facilities, enables Aerofin to select just the right surface and materials for each particular job. Aerofin rigidly controls every phase of the production of its heat-transfer coils and units.



This man is looking for air bubbles – he is testing Aerofin heat-transfer coils with air pressure in a specially illuminated tank. If there are no bubbles, it means the immersed Aerofin unit has withstood the severe strains of steam and hydrostatic pressure tests and is ready to give you long, efficient service.



Throughout the Chemical Industry –

Aerofin units do the job Better, Faster, Cheaper

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of employee stock purchase plans," said Dr. Willard H. Dow, president. "However, we have studied similar offerings by other companies in recent months and on this basis of comparison feel that our program was exceptionally well received."

### Girdler Making Survey for New Ammonia Plant

THE Girdler Corp. of Louisville, Ky., has been retained by the Mississippi Chemical Corp. to make an engineering survey preliminary to the construction of a $12 million anhydrous ammonia plant in Mississippi. Owen Cooper, executive vice president of Mississippi Chemical, says the survey is being made to establish a location for the project and determine its capacity and entire scope of its operations.

### Freight Rates Raised For Emergency Relief

DURING January Interstate Commerce Commission granted the railroad carriers another general freight rate increase, averaging about 5 percent. This was an interim authorization in the formal case in which the railroads asked for a general thirteen percent advance. Incidentally, it makes prevailing freight rates generally about 45 percent higher than they were on V-J Day.

Most significant for process industry in further discussions is the question as to whether these blanket increases will permanently apply to all commodities. In some cases very important exemptions with ceilings on increases have been set, as in the case of fertilizer chemicals and mixed fertilizers. There remains a question as to how new permanent rate raises will be applied on this class of goods.

### Humble Chemical Engineers Elect Gwin President

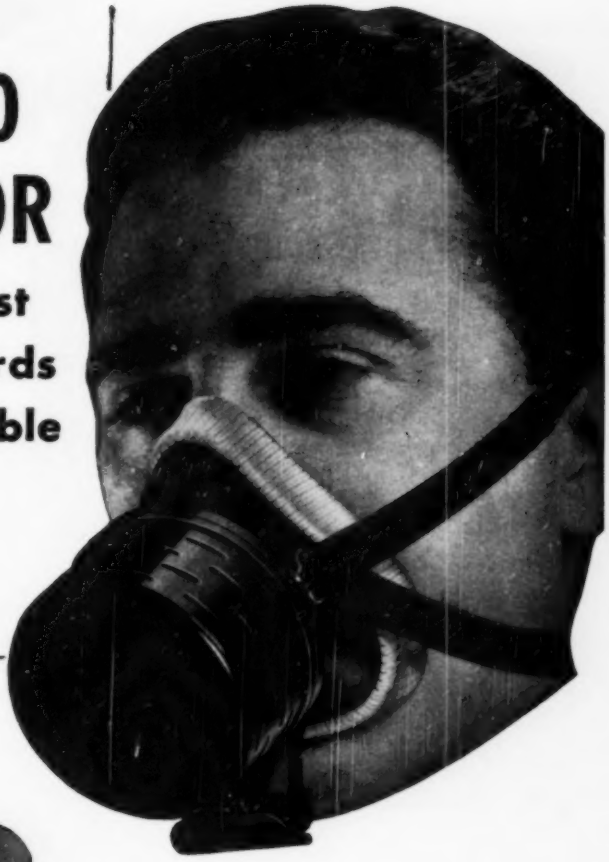
GILMORE T. GWIN has been named president of the Society of Professional Chemists and Engineers, Humble Oil & Refining Co., Baytown, Tex. Membership in this group is limited to non-supervisory engineers, physicists and chemists with one or more years of service with the company.

The present total membership of about 190 covers more than 90 percent of the eligible technologists at the Baytown refinery, about 25 mi. outside Houston. The society is considered the only economic purpose organization of professional men in Texas, and is one of the few groups

# Comfortable AO R-1000 RESPIRATOR

## Protects Against Over 140 Hazards by 7 Interchangeable Cartridges





Called the "7 in 1" respirator because of its seven interchangeable cartridges, AO R-1000 Respirator provides perfect protection against more than 140 noxious and nuisance gases, vapors and dusts.

Construction of the cartridge combined with design adaptability of the respirator make breathing easy — the inhalation valve admits air at the lightest intake of breath — exhalation valve provides complete air expulsion. The valve cannot stick. Moisture cannot collect. Dust cannot infiltrate. Due to rubber pliability and smoothly rounded face contacting edges, the AO R-1000 Respirator fits any face safely and comfortably *without adjustment.*

The AO Respirator Guide, showing proper protection against specific exposure hazards, is yours for the asking.

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*New*

# 250 VA STABILINE IE

## VOLTAGE REGULATOR

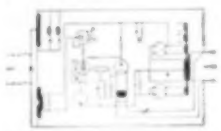
The new 250 VA STABILINE Type IE51002 is the latest addition to the Superior Electric line of dependable instantaneous electronic automatic voltage regulators. It's easy to carry this compact, portable unit to any location in shop or laboratory — from one test station or operation to another. And packed into its black, wrinkle-finished case are the same superior characteristics of workmanship and performance found in STABILINES of larger capacity.

Here are the ratings for the new 250 VA STABILINE Type IE51002 — **Input Voltage Range:** 95 to 135 volts. **Output Voltage Range:** adjustable between 110 and 120 volts. **Rated Output:** 0 to 250 volt-amperes. **Frequency in Cycles:** 60 ± 10%. **Load Power Factor:** 0.5 lagging to 0.9 leading. **Waveform Distortion:** never exceeds 3%. **Stabilization:** ± 0.1 volts of preset value. **Regulation:** ± 0.15 volts of preset value. **Recovery Time:** 3 to 6 cycles.

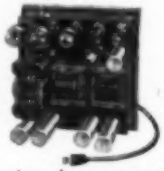
Among the many advantages of this new voltage regulator is the fact that all tubes but one are standard — and the non-standard tube is made by a well-known manufacturer. Tube replacement is thereby made easy — at no extra trouble to you. The 250 VA STABILINE Type IE51002 is easy to order, too. There are no annoying suffixes to watch on your order — no "extras" to buy. The standard cataloged model provides equal or improved characteristics over so-called "special designs".

Each unit is complete, offering all the superior features. Operation is simple. No extra parts or accessories are needed — no special adjustments to achieve maximum performance and service.

The new 250 VA STABILINE Type IE51002 is a self-contained unit measuring 11½" x 11½" x 10¼". It's complete with carrying handle, 6' cord and plug, 2 outlet receptacles and a pair of Superior 5-Way Binding Posts. Fuses are located in the input for complete protection. There's a handy "on-off" switch, pilot light and a screwdriver adjustment for output voltage.



Connection diagram showing operating circuit of the new 250 VA STABILINE Type IE51002.



Rear view shows compactness and fine workmanship in IE51002.

*Write today for complete information*

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**THE SUPERIOR ELECTRIC CO.**

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SEC D

POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLIES • STABILINE VOLTAGE REGULATORS


of its type in the petroleum refining industry.

In addition to Gwin, other officers are Thomas J. Greaney, vice president; Thomas M. Babin, secretary, and William H. Schweitzer, treasurer.

### Wallboard Conference Scheduled For September

THE Northeastern Wood Utilization Council will hold a conference on the subject of wallboards on September 16 in Cambridge, Mass., with the cooperation of Harvard University. The meeting which is believed to be the first one of its kind will cover both softboards and hardboards, their technology and economics.

### Delaware University Starts on Navy Squid Project

UNIVERSITY OF DELAWARE chemical engineering researchers have received the backing of the Office of Naval Research to enable them to participate in Project Squid, a fundamental research program on jet propulsion, a Navy-sponsored study.

Dr. Robert L. Pigford, chairman of the chemical engineering department, said the Office of Naval Research contract will facilitate work for one year on a project involving "Heat Transfer in Passages with Free Convection and Counter Flow," on which S. A. Guerrieri, assistant professor of chemical engineering, is the chief investigator.

### Columbia Adds Engineering to Pharmacy With Good Results

A UNIQUE plan of cooperation between the college of pharmacy and the school of engineering at Columbia University, devised with the aim of providing men with both pharmaceutical and engineering training for the drug industry, has met with success during the past year, according to Charles W. Ballard, dean of the College of Pharmacy.

Dean Ballard's plan of collaboration with the engineering school was proposed to Columbia in 1939. Final arrangements were held up by the war, however, and a complete program has not yet been attained, he said.

As an example of the success encountered in the early phases of the plan, Dean Ballard cited the results attained by one pharmacy student who enrolled in several courses in the school of engineering. While engaged in his engineering work, the student drew up plans of a proposed pharmaceutical manufacturing development laboratory. It included de-



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## Thanks to Hackney construction!

Long life and Hackney 2-Piece Acid Drums are synonymous—thanks to Hackney design and construction. First of all, seamless cold drawn construction means a stronger container. Then, there are no longitudinal or chime seams—just a single circumferential butt weld located between and protected by two I-bar rolling hoops.

Add to this sturdy construction special heavy forged spuds to eliminate bung failures. Then, add reinforced chime protectors for extra strength and prolonged life. And then to increase resistance to corrosion, the finished container is stress relieved in automatic time and temperature controlled furnaces.

That's why Hackney Drums make so many extra trips—why they are such economical containers.

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tails for the placement of laboratory equipment, power requirements, and other installations, as well as operating information.

The students plan, Dean Ballard said, represented a combination of the pharmaceutical and engineering knowledge required in setting up and operating a plant project of that type. The student was readily placed in a position with the drug industry, Dean Ballard added.

### Instrument Society Spring Meeting in Toronto

THE FOURTH annual spring meeting of the Instrument Society of America will be held at the Royal York Hotel, Toronto, Canada, on May 12 and 13. The announcement was made by Ed Grace, chairman of the national meetings committee and chief instrument engineer of the Sun Oil Co.

The tentative program will include four technical sessions and a dinner on Thursday evening, May 12th. The technical program will be under the direction of Lyman Allen, Jr., chairman of the papers subcommittee of the national meetings committee and assistant design engineer, American Viscose Co. The meeting will be of interest to all engineers engaged in measurement, inspection, testing and automatic control.

### Synthetic Fuels Program Still Pushed by Government

THE GOVERNMENT still wants someone in the synthetic liquid fuels business, either private industry or government.

President Truman's budget message recommends government-financed assistance in the production of synthetic liquid fuels from coal, lignite, and oil shale.

The budget allows $31 million for this purpose in fiscal 1950—$1 million to cover administrative expenses of such an assistance program and $30 million in contractual authority as the government's possible share in the cost of constructing such a plant, or plants.

The $30 million figure alone would build a plant with a capacity of about 5,000 bbl. a day, as against the commonly talked of 10,000 bbl. per day plant costing around $100 million. Government hopes to share expenses of the larger plants with private industry—would prefer them built without federal aid.

Meanwhile Bureau of Mines announces two variations of Fischer-Tropsch process and a new approach

# Modine Coils Heat Huge Caterpillar Engine Factory



This is Caterpillar's new diesel engine factory. The 214 Modine Coils which heat it handle 2,555,000 cubic feet of air per minute—an amount equal to the space occupied by an elevator shaft 5½ miles high! Note the eighteen penthouses on the building's roof. These house the heating coils that furnish 160,000,000 BTU per hour.



Non-overloading type fans supply heated air to the production floor through ducts (see arrow). Caterpillar officials find employees like this comfortable, healthful heating system.

Fresh air—or a mixture of fresh and recirculated air—is passed through heating coils to the air washer. Heated air is there washed and supplied to the fans for circulation.

***214 Modine Coils in New Plant Furnish 160,000,000 Btu/hr.***

•

PEORIA, ILLINOIS—Busy turning out engines that will give life to the equipment it builds is the mammoth new Caterpillar Tractor Co. engine factory located at Peoria, Ill. This single building covers 22 acres of land . . . contains 32 acres of floor space.

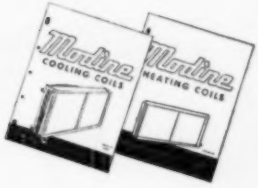
•

To solve the problem of heating a building this large, Caterpillar engineers selected 214 Modine Non-Freeze Heating Coils.

•

Like Caterpillar and many other well-known firms in industry—you can rely on Modine to give you the right answer to your heating or cooling coil problems. With 8 types and more than 3600 models and sizes to choose from, it's easy to select the right Modine Coil to fit your specific heating, air-conditioning or processing requirements. Get complete catalogs. Call the Modine Representative listed in the "Where-to-Buy-it" section of your phone book, or write Modine Manufacturing Co., 1525 Dekoven Avenue, Racine, Wisconsin.

***Send for New Modine Heating and Cooling Coil Catalogs Today!***



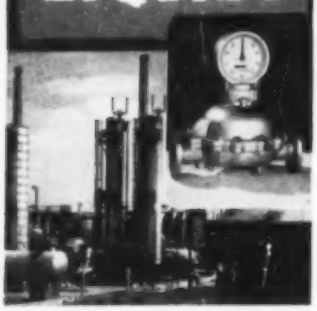

**Memo to Equipment Manufacturers**

If you build equipment using heating or cooling coils, Modine engineers will be happy to work with you in developing coils which exactly meet your specific requirements. Write today!

C-1021

# *Modine* COILS For Heating and Cooling

Meter
CORROSIVE LIQUIDS



with the new NIAGARA
CHEMICAL METERS

NOW you can obtain accurate measurement of corrosive liquids with a meter that will operate with high resistance to corrosive action! That's the outstanding combination you get with the new NIAGARA Stainless Steel Chemical Meter — manufactured by the Buffalo Meter Company.

NIAGARA chemical meters have works of type 316 stainless steel so can be used, under correct conditions, for many liquids including:

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| Sodium hydroxide | Acetic acid |
| Sulphuric acid (95-100%) | Calcium hydroxide |
| Fruit juices | Vinegar |
| Vegetable juices | Alum, potassium sulphate |
| Soap | Calcium chloride |

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Please send me full information on construction and capacity specifications of your new NIAGARA Chemical Meter.

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to the Gergius-I. G. Farben method of hydrogenation.

In an effort to increase effective use of synthesis gas (a mixture of carbon monoxide and hydrogen), which accounts for over two-thirds the cost of synthetic fuel production, Bureau of Mines has come up with two methods which yield a high percentage of oil and a relatively small amount of hydrocarbon gases.

First is the internally cooled fixed catalyst-bed method where the heat of synthesis reaction is efficiently and rapidly removed by circulation of a relatively non-volatile oil through a bed of catalyst granules. Oil yield here is 30 percent higher than the standard fluidized-iron catalyst method, and gas yield the same.

Second variation of the Fischer-Tropsch process is the oil-catalyst slurry method, which produces 25-50 percent as much gas and a high yield of high quality liquid products at the same time. In this case, a powdered catalyst is suspended in an oil that is non-volatile under operating conditions. Synthesis gas is bubbled through the suspension.

Coal hydrogenation research projects include rapid conversion of coal to distillable oil, gas, and coke at moderate pressure and high temperatures; replacement of hydrogen with water gas; hydrogen production from byproduct hydrocarbon gases; and a final method whereby twice as much coal as normal is fed through plant with the result that half the coal is converted to oil and gas and the other to coke. In this procedure all hydrogen in the half that becomes coke appears in the oil and gas.

Biggest problem now before the Bureau of Mines is the job of finding suitable catalysts for hydrogenation of the coal solution.

## READERS' VIEWS AND COMMENTS

### Continuous Chromatography

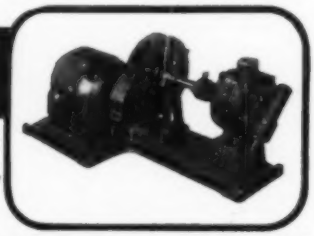
*To the Editor:*

*Sir:*—Your recent article on chromatography in the November issue of *Chemical Engineering* has been read with great interest. Also on this side of the Atlantic development work is being carried out on the subject.

It would be of considerable interest to one of my clients to find a basis for exchange of information. It is felt that the application of a new principle different from the Hypersorber

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VIKING PUMPS

That's right . . . with a Viking, you get a tough, rugged pump, one with long life, one with only two moving parts, one that will pump any clean liquid regardless of viscosity and the most complete range of capacities, sizes and styles from which to choose.

PUMPS ANY CLEAN LIQUID!



But added to this, you get . . .
Self priming (no added gadgets)
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And a dependable pump that is built to do the job intended.

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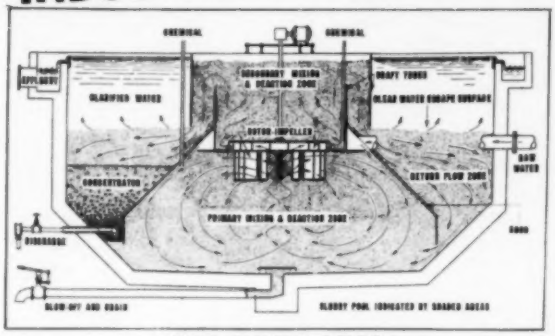
Ask for free folder 495C today.



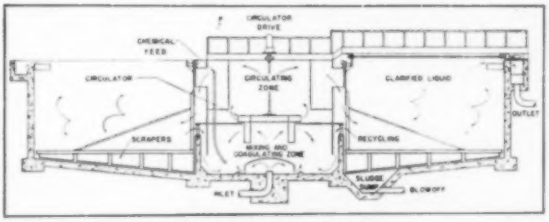

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THE CYCLATOR



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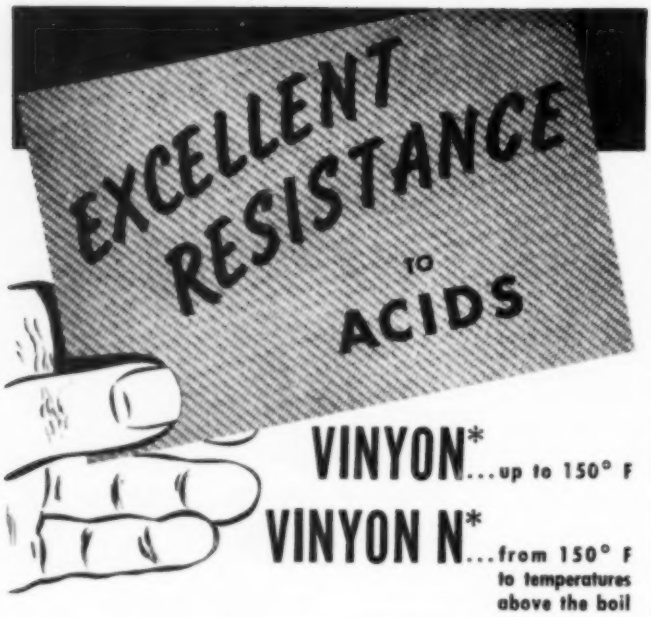
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**They also exhibit a high degree of stability under most conditions where caustic solutions are encountered and are therefore excellent general purpose filter media.**

**We will weave NFM VINYON* and VINYON N* Filter Fabrics to your individual order in any desired width from 26" through 72" in quantities as low as 100 linear yards. Or, if you prefer, we will prepare your filter element covers for you with all sewing being done with VINYON* and VINYON N* Sewing Threads of course.**

**In the more than forty years in which our organization has been engaged in weaving Industrial Filter Media, we have developed the "know how" necessary to produce Synthetic Fiber Filter Media which have superior filtering characteristics.**

**Don't Forget the Other NFM Types of Synthetic Filter Media:**

**Glass — Nylon — Orlon† — Saran**
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process can be successfully employed. In view of the importance of chromatography as a unit operation for many industries, direct contact with American industry looks advisable. Engineering departments here are handicapped by shortage of material and skilled personnel and it is possible that some fundamental research here in Europe would lead more quickly to commercial development when done in cooperation with American technicians.

I wonder whether you are in a position to assist me in bringing the right parties together. You might be able to refer me to a particular company or advise me in another way. Your cooperation will be greatly appreciated.

GABRIEL BOSSCHIETER

Molenlaan 39
Rotterdam-Noord
The Netherlands

• *Any volunteers?—Editor.*

## Hydraulic Radius—I

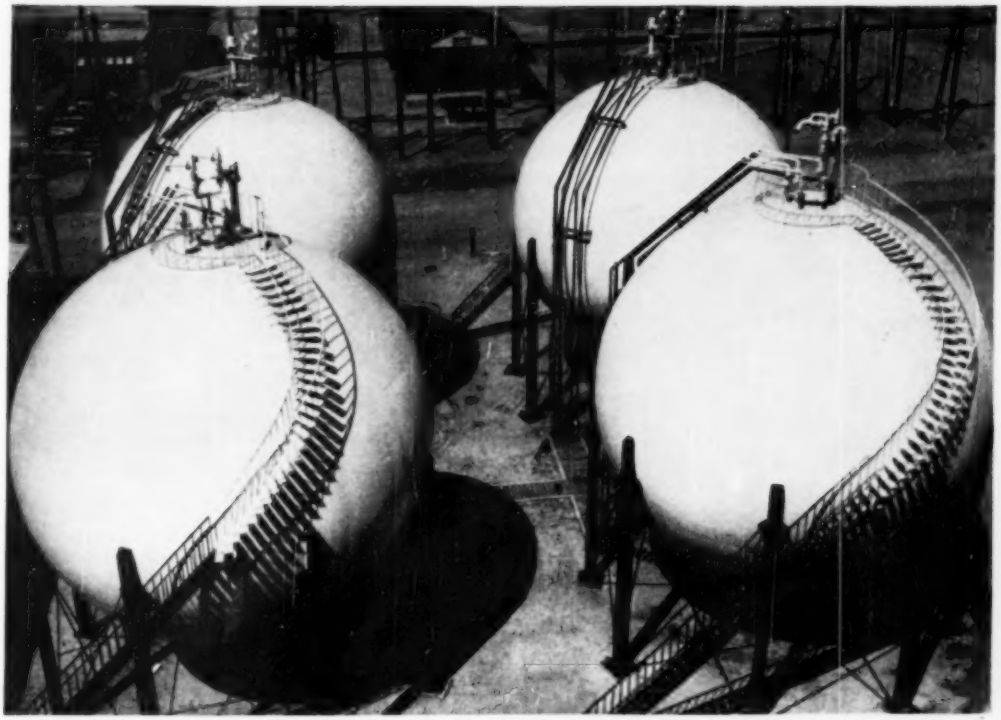
*To the Editor:*

*Sir:*—Prof. Teller's letter in your November issue makes the point that the hydraulic radius (or hydraulic mean depth) of a partly-filled circular pipe passes through a maximum value.

The derivation has already been given in Gibson's "Hydraulics and Its Applications," (2nd edition) London, 1919 (pp. 301-2) where it is shown that, for maximum velocity, the angle at the center subtended by the wetted perimeter is 257½ deg., while, for maximum discharge, the corresponding angle is 308 deg., "so that a circular conduit will give its maximum discharge when the depth of water is about 0.95 of the diameter, the discharge then being about 5 percent greater than when completely full."

Earlier still, the late Prof. John Goodman, of the University of Leeds, diagnosed several cases of flooding at the approach end of a culvert as being due to the reduction in hydraulic mean depth when a conduit which is nearly filled becomes completely filled. He also carried out experiments to confirm the theory. For further particulars reference is directed to his paper "The flooding of the approach end of a culvert due to a small rise in the level of the water at the outlet end" in the *Proceeding of the Institution of Civil Engineers*, 186, pp. 434-444 (1911). As he points out in his paper, flooding is more liable to occur with a culvert of rectangular cross-section. For such a culvert, of breadth $B$ and depth $D$, the hydraulic mean depth when water flows just

# HORTONSPHERES



## . . . their job is to hold on to volatiles

The spherical design of the Hortonsphere is an expression of the thoroughness with which it has been developed to store gases and volatile liquids—its spherical shape is ideal for resisting internal pressure. When volatile contents exert an internal pressure, a Hortonsphere's shell is equally stressed in all directions. The result is that, for this kind of service, a sphere makes the most efficient use of the materials of which it is built.

Another advantage resulting from the Hortonsphere's shape is its availability in large capacities. A spherical pressure vessel can be built for efficient operation in capacities up to 25,000 bbls. and will provide volume storage more economically than a battery of smaller units.

Some of the products stored in Hortonspheres at chemical plants include hydrogen, anhydrous ammonia, and carbon monoxide. Pressure settings for these installations range from 30 to 150 lbs. per square inch for capacities up to 2,000-bbls.; 30 to 125 lbs. for 2,000-bbl. capacity; 30 to 100 lbs. for 5,000 and 6,000-bbl. capacities; 30 to 75 lbs. for 7,500 to 12,000-bbl. capacities; 30 to 60 lbs. for 15,000-bbl. units and 30 to 50 lbs. for 20,000 and 25,000-bbl. capacities.

You can get details from our nearest office, without obligation on your part.

*These Hortonspheres at the Spencer Chemical Company's plant at Military, Kansas, are 38 ft. in diam. They are used to store anhydrous ammonia at 75 lbs. per sq. in. pressure.*

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**UNIT** Portable powered units, like the Standard Handi-Belt shown here are a real time and labor saver. They handle boxes, bags, cases and small bales with equal facility. Reversible power drive permits higher stacking and handling in warehouses. Makes for faster unloading and loading in trucks or cars. Can be used in confined space. Plug-in any local outlet.



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Standard
GRAVITY & POWER
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clear of the top is approximately $(BD)/(B + 2D)$ but, as soon as the water reaches the top of the culvert, the hydraulic mean depth becomes $(BD)/(2B + 2D)$.


A. J. V. Underwood
Consulting Chemical Engineer
London


### Hydraulic Radius—II

*To the Editor:*

*Sir:*—I wish to comment on the paradox posed by Prof. Teller in the November issue of *Chemical Engineering*, which is concerned with the application of the concept of the *hydraulic radius* for determining fluid friction, particularly by means of the Fanning or similar equations.

While the result appears paradoxical, the matter is not incredulous; indeed, Prof. Teller appears to have arrived at an erroneous conclusion in part where he says, p. 246, "obviously an incorrect conclusion." This statement itself appears to be incorrect, while the subject conclusion is correct, to wit, a pipe flowing half full has the same pressure drop due to friction as a pipe flowing full, other things being equal. It is almost self evident that this is so. Imagine a circular pipe flowing full, and pass an imaginary frictionless plane through the diameter of the pipe. Since the flow is unaltered by the frictionless partition, the pressure drop for both semicircular conduits must be equal to that of the entire circular section.

As a further consequence of the above, a pipe flowing not quite full can carry more than one flowing full. This appears to be a paradox, but it is not inexplicable. Incidentally, a still further consequence is that a pipe laid to a constant slope will never flow full, provided the entrance head is not so great that it overcomes the effect of pipe friction. The mathematics submitted by Prof. Teller which shows that a maximum hydraulic radius occurs when the pipe is flowing not quite full is quite correct. That such a maximum exists can be proved by nonmathematical means as follows:

The fluid friction is some unspecified function of the Reynolds number, the latter being the ratio of the dynamic forces to the friction forces. With other things constant, i.e., all variables associated with the fluid, the remaining variables comprise the ratio of the cross-sectional area of the stream to the wetted perimeter, which latter is defined as the hydraulic radius. Visualize a circular conduit flowing half full, and it can be seen readily that with increasing depth of flow, the ratio of area to perimeter for each




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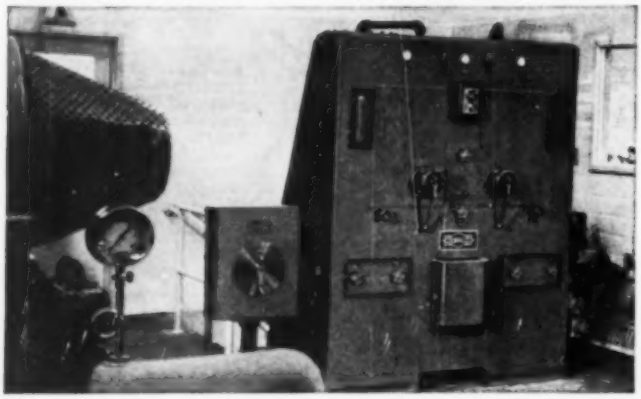
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increment of depth becomes smaller. Now from simple geometery, we know that the hydraulic radius is the same for the pipe flowing half full as it is for the pipe flowing full; consequently, the hydraulic radius must pass through a maximum somewhere between the half depth and full depth.

In King & Wisler's "Hydraulics" this matter of minimum hydraulic radius for circular conduits is discussed.

In connection with this subject it might be noted that there is another circumstance where "the part is greater than the whole." However, in the example given below we do not have a paradox, but an error of application.

Prof. George E. Russell in his "Hydraulics," 5th Edition, Holt (1942) p. 282 calls attention to the case where a channel has two widely dissimilar depths, say 12 ft. and 2 ft., and each section 50 ft. wide, if the hydraulic radius is computed for the entire section and substituted in the Fanning formula, the flow is less than when it is computed for the deeper section alone. The source of the error lies in the mistake of taking the average of the inertia forces for the combined section in the ratio to the average of the friction forces, which has no physical significance. The larger amount of kinetic energy in the deeper stream is only dissipated by the walls for this stream; similarly, only a smaller amount of kinetic energy can be dissipated in the shallower stream, with the consequence that the velocities of the two streams are dissimiliar.

I believe that errors in the application of hydraulic radius function to problems of hydraulics would be avoided, if one keeps in mind the physical significance of the Reynolds number—the ratio of inertia forces to friction forces—and that the hydraulic radius has no physical significance apart from the Reynolds number.

CONSTANT READER

New York

## Hydraulic Radius—III

*To the Editor:*

*Sir:*—May I offer my thanks to "Constant Reader" for his comments on the problem I raised concerning the hydraulic radius concept.

I agree with him and the examples he noted that the physical significance of the problem must be kept in mind, in fact, that was the purpose of my missive.

However, I cannot agree with his reasoning in his explanation for the indicated equality of friction drop for

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a one half filled pipe and fully filled pipe. In his explanation, he suggests passing a frictionless plane through the center perpendicular to the cross-section. He contends that this operation will not alter flow conditions and that, therefore, the pressure drop must be the same for a fully filled and half filled pipe. I disagree on two points.

If the frictionless plane did not affect flow conditions and, therefore pressure drop, a frictionless plane could be passed through any one of an infinite number of chords (horizontal if necessary) of the cross-section in a manner similar to that he suggested. Following his reasoning, the pressure drop for a pipe ¼ full should be equal to that of a pipe ¾ full, or the friction drop for a pipe 0.99 full be equal to that for a pipe 0.01 full, or the pressure drop for any cross-section would be equal to that for any other cross-section. This is physically impossible.

He neglects, in his reasoning, the results of frictional effects within the fluid itself, due to eddy currents and viscosity. By passing a frictionless plane through the fluid, contact is lost between the fluid on both sides of the plane, thus both friction between planes of fluid due to viscosity and eddy currents in the fluid body are neglected. These effects contribute (in addition to skin friction) to the increase in magnitude of the friction drop for a fully filled pipe over that for a pipe half filled.


A. J. Teller

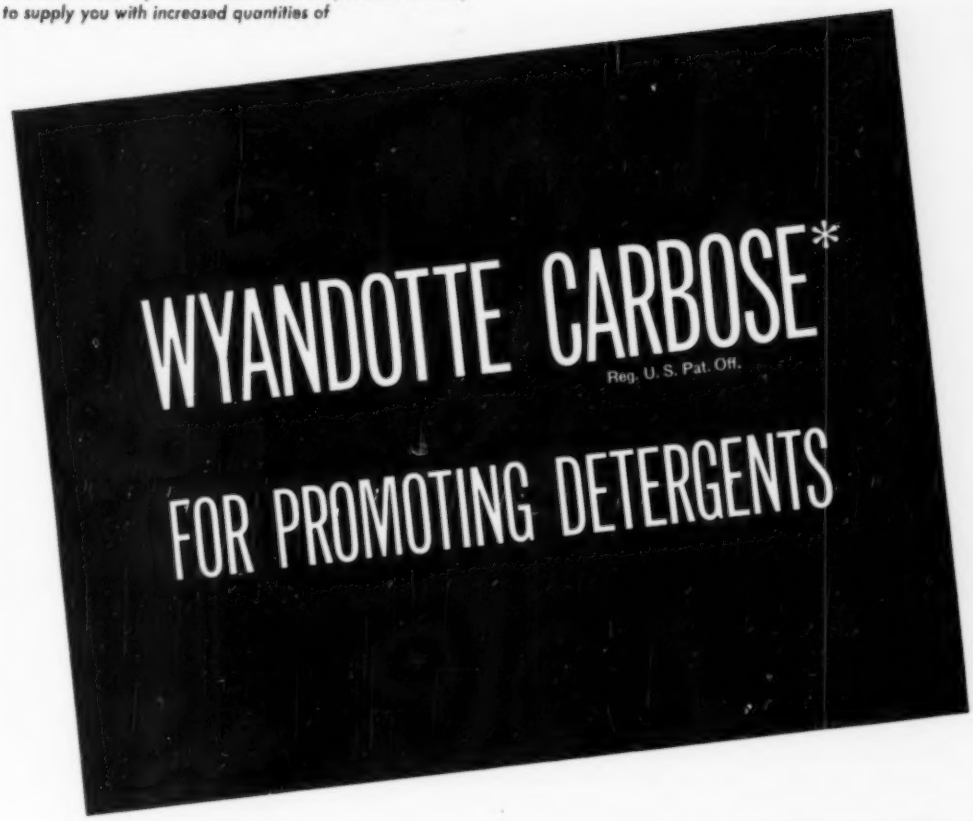
Penn College
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## Log Mean Nomograph

It has been brought to our attention that a nomograph for determining logarithmic means, which was similar to the contribution of Mr. John P. Snyder appearing on page 120 of our January, 1949 issue, was first developed by B. M. Thornton and published in the English magazine, *Engineering*, in 1931. This information was supplied by Mr. Hugh Griffiths, eminent chemical engineer of London. Mr. Earl W. Holdgraf, of the department of chemical engineering at the City College of New York, has also pointed out that a similar nomograph appeared in Manual 837, a publication of the Pfaudler Co., dealing with heat exchangers and condensers, which was published in 1946.

Mr. Snyder's contribution was developed independently and without knowledge of the prior appearances of similar charts. It was submitted and accepted in good faith and both author and editors regret and retract any claims to novelty inherent in its current publication.—*The Editors.*

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# NEWS FROM ABROAD

*Special Correspondence*




Nylon Spinners sell stock . . . Fish for cosmetics
More cyanide for South Africa . . . Rail rates in India
due for overhaul . . . Anzacs get high-vacuum

### More Capital Going Into British Nylon Spinners

LONDON—Imperial Chemical Industries and Courtaulds, joint partners in the ownership of British Nylon Spinners, are expected to take up all of the $8 million increase in the nylon company's common stock capital authorized recently by the Capital Issues Committee.

This issue is a further stage in providing the necessary finance in connection with the company's new plant for the production of nylon yarns which has now been completed near Pontypool in the South Wales Development Area.

Production has already started in part of this new factory, which has a floor space of approximately a million square feet. Installation of machinery is proceeding rapidly in the remainder of the plant.

The plant, when working at full capacity, will employ 1,700 men and 300 women, and will produce nylon yarn at the rate of 10 million pounds per year, approximately ten times the present rate. The company is the only nylon spinner in the United Kingdom. It was formed in 1940 by Courtaulds and Imperial Chemical Industries jointly. The capital was increased to $24 million in January 1947.

### Fish Oils for Cosmetics Studied in Canada

VANCOUVER—Director of fisheries bureau of the Japanese government is urging the production of cosmetics from fish products. This has resulted in some theories being given to this publicity in British Columbia. Lyle Swain, associate research chemist with Pacific Fisheries Experimental Station of the Dominion government at Vancouver, B. C., states that fish oil could be used for any beauty preparation requiring oil. He thinks herring oil is less liable to rancidity than that of pilchard, and he states that salmon could also be used. Egg oil of salmon is a beautiful red color that would make a beauty cream look like a fine strawberry.

Dr. Swain states that cod liver oil is needed for manufacture of vitamins and while it could be used for beauty preparations, it is more valuable for vitamin purposes. Whale oil could also be used in beauty preparations.

### CMC Output planned In Netherland

AMSTERDAM—AKU (rayon) of Arnheim is going into the plastics line with production of carboxy methyl cellulose.

AKU's staple fiber production in 1948 was 9,600 tons, as compared with 7,800 in 1947 and 1,500 in 1946. About 7,000 tons was exported, of which 4,100 went to the dollar area.

### South Africa Gets New Calcium Cyanide Production

JOHANNESBURG—Using a newly-developed process, a South African factory will soon begin producing cyanide entirely from local raw materials. The calcium cyanide produced will meet about one-third of the requirements of the local gold mining industry.

African Explosives and Chemical Industries has built a factory near a sewage disposal works because of the sewage gas produced there. The methane in the gas is suitable for producing calcium cyanide. Cooling water will also be obtained from the sewage works effluent.

The output will be governed by the amount of sewage gas available, but the indications are that 3,000 tons will be produced a year.

The new factory is the result of experiments conducted in a pilot plant (constructed in 1937) under the direction of Imperial Chemical Industries. Tests showed that the calcium cyanide produced was interchangeable with sodium cyanide which is now being used in the mines.

### Indian Chemical Firms Plea For Uniform Rail Rates

NEW DELHI—The Indian Chemical Manufacturing Assn. has made a strong plea to the government to revise exorbitant and unstandardized rail rates on chemical raw materials and products which the association charges is restricting the growth of the industry.

Some anomalies pointed out: it is cheaper to ship bauxite from South America to inland Canada than it is to rail it from one Indian province to its neighbor; a western India factory can obtain petroleum coke cheaper from America than it can from the northeastern Indian province of Assam; the cost of nux vomica is increased up to 500 percent by rail charges between the province of Orissa and the port of Calcutta.

Range of variation in transport charges per metric ton per 500 mi. in different parts of India are given as follows: sulphur, from approximately $3.75 to $9.25; lime and limestone, from $2.80 to $6.45; bauxite, from $2.20 to $4.65; coal, from $1.60 to $7.50; sulphuric acid from $18.50 to $31.

### Shell Building High-Vacuum Still in Australia

MELBOURNE—A high-vacuum still for production of medium viscosity index lubricants and of road-surfacing bitumen will be built by Shell at Geelong, Victoria. The installation is estimated to cost $5 million. It will take two

years to complete. Shell officials won't say what the capacity will be, but they disclosed that 500 operatives will be employed at the plant.

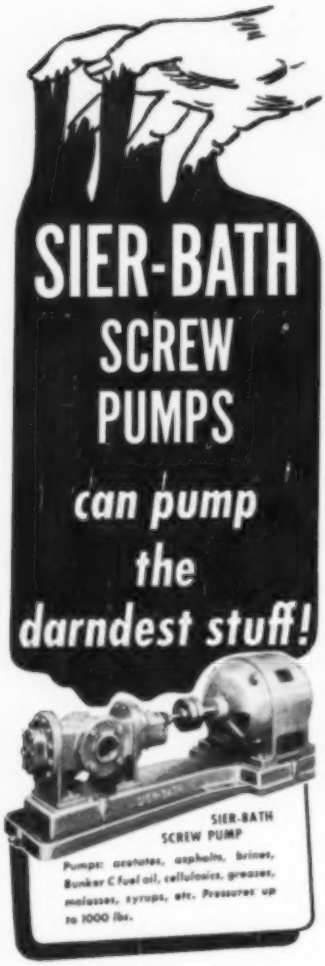
Though 95 percent of Australia's petroleum imports are refined products, the proportion is smaller than it was prewar and plants under construction will reduce it still further. The new Australian capacity will not compete with the refineries in Indonesia.

Near the projected Shell refinery, at Altona, the Vacuum Oil Co. is erecting a $1,500,000 still. It will be able to treat 15 million imperial gallons of crude annually and will yield a substantial proportion of lubricating oil in addition to asphalt and diesel fuel.

## British Chemical Industries Trying to Encourage United States Investments in British Plants

LONDON—Considerable interest has been aroused in the British chemical industry by the statement of the president of the Board of Trade that the British Government is prepared to consider and welcome any schemes of American capital investment in Great Britain and the Commonwealth. It is known that of the "number of applications, some quite substantial, received" several are connected with new chemical enterprises. Subsidiaries of U. S. companies operating in the British Isles have been no less active than British firms in the development of new productions, and in the field of organic chemicals in particular. American firms are expected to make a valuable contribution to the expansion of the petroleum refinery capacity, the establishment of the carbon black industry, and the development of new hydrocarbon chemicals.

In view of the extensive licensing regulations in force, new factory construction projects cannot be undertaken with any hope for early completion without government approval. Official support, however, is promised for all investment schemes which help towards the main objective of British economic policy—viability by 1952. Viewed from this angle, all industrial projects which tend to reduce the demand for foreign-produced petroleum derivatives certainly deserve government encouragement. It is hoped that the authorities will help the U. S. oil company which has been reported to consider an extension of its refining facilities on Southampton Water, and will likewise encourage United States


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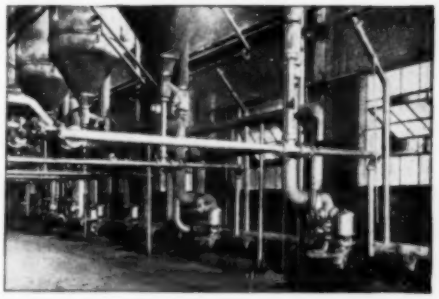
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participation in the erection of carbon black plants, to say nothing of minor instances of Anglo-American cooperation in inaugurating new expansions which have been reported from various British industrial centers during last year.

Monsanto Chemicals Ltd., British subsidiary of Monsanto will manufacture polystyrene in Britain. The styrene polymer will at first be imported from the United States but is later to be made locally in plants already scheduled. Monsanto recently acquired control of Silicon (Organic) Developments Ltd. which has devoted considerable attention to modified forms of silicon esters. Monsanto has made available to the woolen industry a colloidal silica known as Syton which is a stable dispersion of submicroscopic particles of silica in water. Relatively small amounts of Syton deposited on the wool fiber act as an anti-lubricant, increasing the drag between fibers and causing them to slip past one another at constant speed.

### Petroleum

The Anglo-American Oil Co., subsidiary of the Standard Oil combine, has announced plans for the extension of its oil refining operations in the British Isles from 750,000 tons at present to 5,650,000 tons. If and when this project is carried out fully, the refinery at Fawley, on Southampton Water, will be the largest of its kind in Britain and, as far as is known, in Europe. Unlike other companies which have announced extension schemes for their petroleum refineries, the Anglo-American Oil Co., however, has not yet made it known whether it intends to enter the field of petroleum chemicals itself or whether it proposes to dispose of the refinery output of byproducts suitable for chemical utilization sale to other firms.

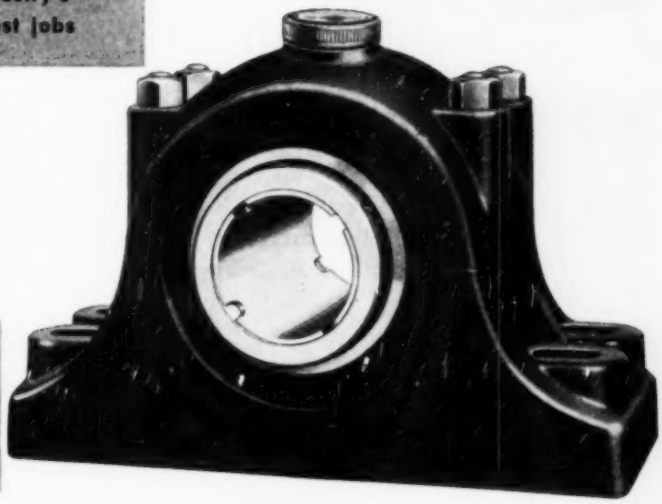
In the carbon black industry which is only now being created in Britain, U. S. interest is, as far as can be ascertained at present, confined to technical cooperation, advice on questions of design and construction, and licenses for the use of American patents. As this industry is entirely new to Britain, the capital required is largely provided by private sources assisted by government-sponsored finance corporations, while an approach to the public issue market is not for the time being envisaged. Unconfirmed reports, however, mentioned one particular American firm as being interested in a scheme providing for actual financial participation.

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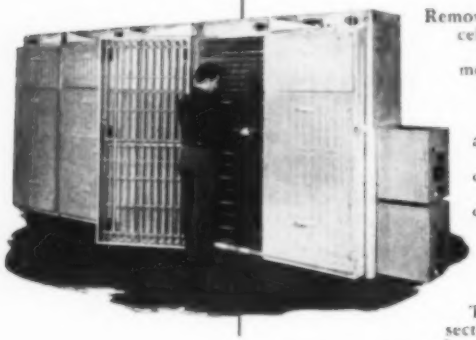
***CALL THE TRANSMISSIONEER.*** Look for the name of the Transmissioneer, your local Dodge distributor, under "Power Transmission Equipment" in your classified telephone directory.

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

# Super-Clean Air with Simplified Maintenance

**ELECTRO-CELL KEEPS DUST AND SMOKE OUT AND OPERATING COSTS DOWN**

YOU get super-clean air at a saving with the installation of an AAF Electro-Cell. This modern electronic precipitator gives positive protection against dust and soot—even down to such fractional micron sizes that its true efficiency can only be evaluated by the Discoloration Method of testing.



Removable collector plate cells permit selection of the maintenance method best suited to your operation. Cells may be manually washed and re-oiled in place; removed for easy cleaning in a special tank or washed, dried and recoated automatically with minimum interruption to operation.

The Electro-Cell's sectional construction reduces weight of parts, eliminates multiplicity of electrical connections, protects wiring from dirt and water. And its full-height hinged or removable ionizers minimize electrical losses, reduce ozone and simplify replacement of ionizing wires.

If you want positive protection against soot and dust plus proven savings in operation and maintenance, get complete Electro-Cell data now. Just contact your local AAF representative or write direct for Bulletin No. 252.

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worth £31,402,129 are by far the most important supplier of chemical and allied products to Britain. As it is one of the officially announced aims of investment policy in the British chemical industry to reduce the country's dependence on foreign supplies with regard to all essential chemical products, it must be anticipated that the British import trade, including purchases from the United States and other dollar countries, will be gradually reduced in the coming years. Imports of carbon black, which last year accounted for 30 percent of all chemical supplies from the United States, are to cease completely when the projected plants are in full operation.

British exports of chemicals, drugs, dyes and colors in 1948 amounted to £83,670,282, compared with £67,426,175 in 1947 and £22,279,789 in 1938. Satisfactory as the increase by nearly one-quarter over 1947 is by ordinary standards, the official target for the end of 1948 was not reached in December. This may be partly due to Christmas holiday influences; January exports are expected to be higher.

### Chemical Exports

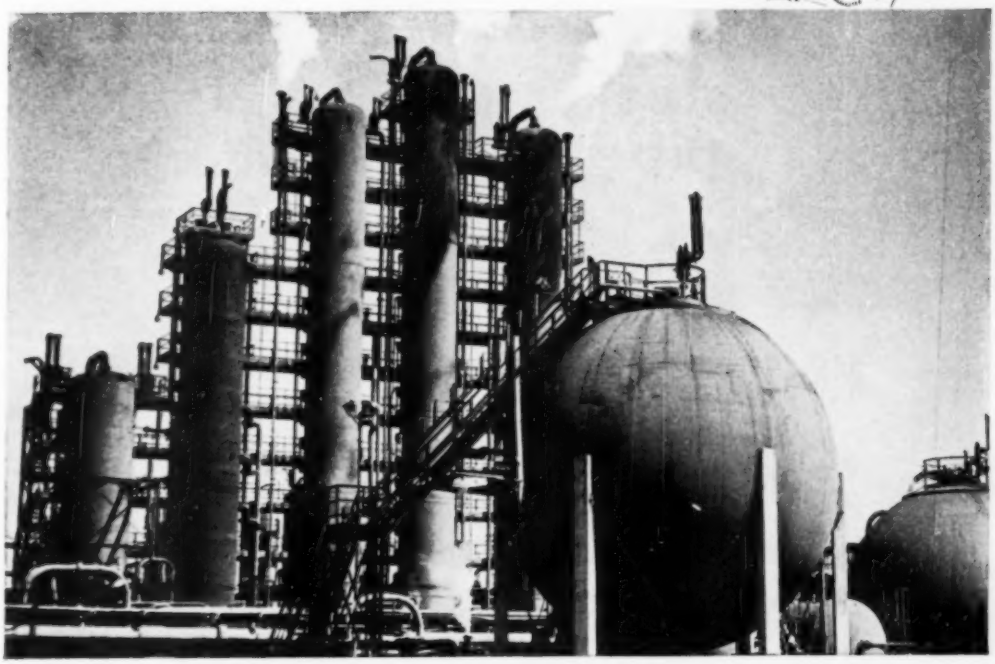
Britain's chemical export trade has been adversely affected by political events in the Far East; China took £1,100,000 less than in 1947. Chemical exports to the United States were only maintained at £2,620,000, and shipments to Eastern Europe were smaller. Substantial gains were recorded in trade with the African continent. The Union of South Africa and the British colonies in East and West Africa bought more British chemicals, and Egypt doubled her imports. Palestine, a comparatively big importer of chemicals with regard to the small size of the country, halved her imports of British chemicals, but most other Middle Eastern and Asiatic markets absorbed somewhat larger quantities. In Europe, the Scandinavian States, the Netherlands, Western Germany and—most important—France all raised their purchases. Canada, Australia, New Zealand and Eire also bought more British chemicals, and so did virtually all Latin-American countries.

An export analysis by main classes of goods, however, indicates that, while the general expansion was satisfactory, products which are not considered essential by importing countries did not fare too well. British exports of drugs and medicinal products rose only from £14,562,000 in 1947 to £15,758,000, dyestuffs, etc., from £7,609,000 to £8,527,000 and insecticides, weed-killers, etc., from £4,456,000 to £5,036,000. Proportionately larger gains were recorded in shipments of paints and colors—£12,-

**IN REFINERY OPERATIONS,** ENDURO Stainless and Heat-Resisting Steel daily is proving its value by providing dependable, uninterrupted service where ordinary materials fail. Its many applications include cracking stills and tubes, condensers and heat exchangers, still lining, hot oil lines, sludge tanks, swing lines, tanks, valves, bubble caps and trays.

*Enduro*-THRIFTY METAL OF 10,000 USES





## . . . AND NOW FOR LOWER MAINTENANCE COSTS

Equipment made of Republic ENDURO Stainless and Heat-Resisting Steels offers many maintenance advantages. *Faster, easier cleaning . . . fewer production interruptions . . . substantially lengthened equipment life . . .* all result from the adoption of stainless steel for vital processing equipment.

ENDURO is not an ordinary metal. It is unusually strong and tough, and highly resistant to extreme heat . . . retaining its exceptional physical properties at high temperatures. It effectively resists the damaging effects of hot gases, rust and corrosion, too. These qualities, plus its easy-to-clean surfaces, make ENDURO a match for the most exacting refinery and chemical requirements.

There are many ENDURO analyses, each designed to meet specific application needs. Talk with your equipment manufacturer or write for more information.

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*Alloy Steel Division • Massillon, Ohio*

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Export Department: Chrysler Building, New York 17, N. Y.

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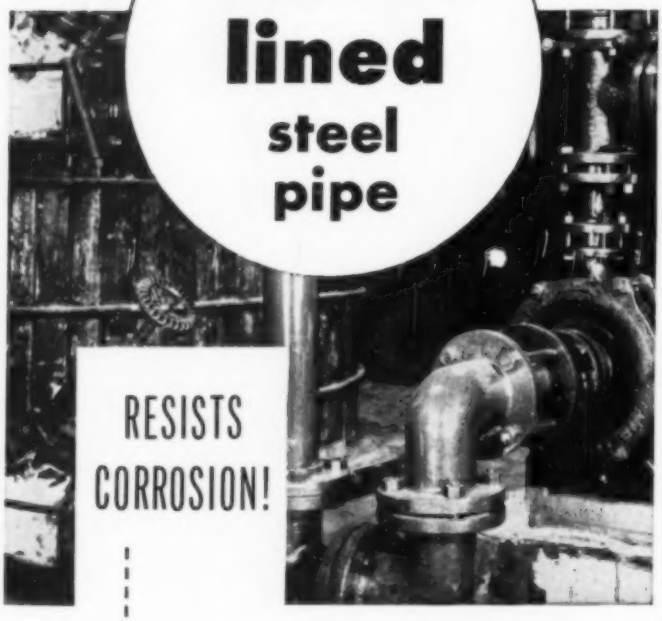
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REPUBLIC STEEL

✓ **Check ALL 10 Advantages:** • RUST AND CORROSION-RESISTANCE • HEAT-RESISTANCE • HIGH STRENGTH • NO METALLIC CONTAMINATION • SANITARY SURFACES • EASY TO CLEAN • EYE APPEAL • EASY TO FABRICATE • LONG LIFE • LOW COST.



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reduces shut-downs!
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Saran lined steel pipe is available in maximum lengths of 10 feet and in sizes from 1 to 4 inches inclusive.

Also available are saran lined plug valves, flanges, reducing flanges, flanged fittings, gaskets and fittings with union ends.

Write us today for further information concerning saran lined steel pipe and how it may solve your problem.

Manufactured by The Dow Chemical Company, distributed nationally by Saran Lined Pipe Company.

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DOW
CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE


811,000 against £8,678,00 in 1947; plastics—£4,417,000 against £3,144,000; and sodium compounds—£10,998,000 against £6,111,000. Exports of perfumery and cosmetics declined from £3,297,000 to £2,958,000, and shipments of coal-tar products increased from £3,079,000 to £3,403,000 but yielded less hard currency owing to a slight falling-off of sales to the United States.

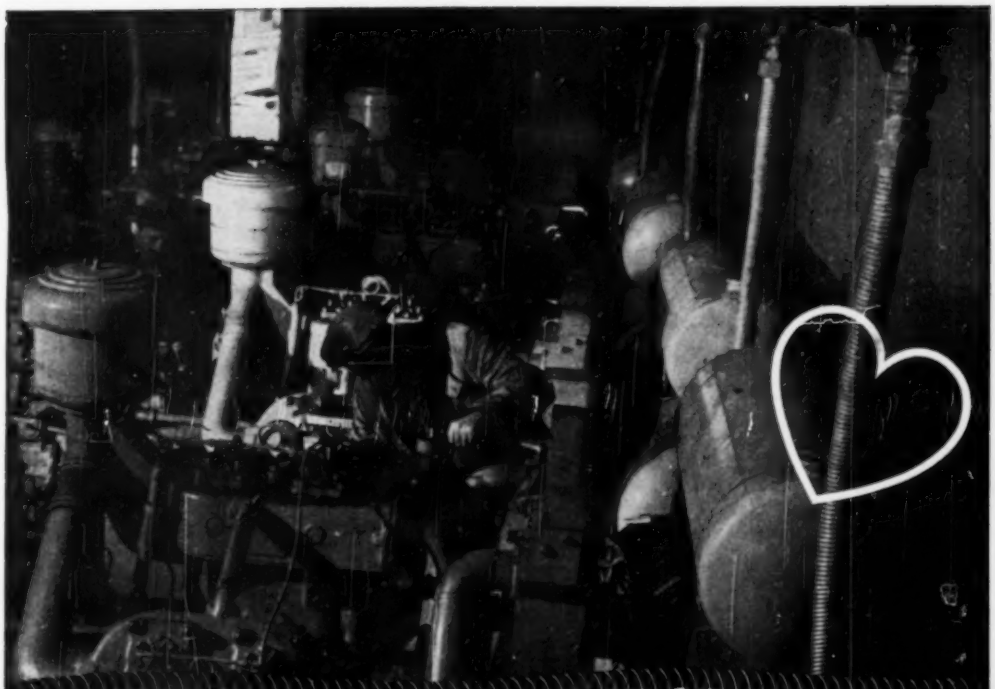
While the continued export expansion is no doubt satisfactory, the relatively heavy increase in shipments of highly-valued essential industrial chemicals indicates that the difficulties and obstacles in the international trade with less essential chemical manufactures, especially medicinal and cosmetical preparations, have been felt to a growing extent. Shipments of essential chemicals to soft currency countries are viewed with somewhat mixed feelings by the British authorities because these materials can often be used with greater advantage by domestic consumers. On the other hand, it has been proved by the attitude of foreign negotiators in recent trade talks that industrial chemicals rank high as counters in such discussions. It is anticipated that more chemicals will be sent to other OEEC countries this year in an effort to contribute to their economic recovery, and chemicals will also be shipped in larger quantities to eastern Europe as a result of recent trade agreements.

The threat of increased German competition which has caused alarm in other British industries does not yet worry chemical manufacturers who have found excellent outlets for their products in markets formerly supplied by German makers. But it is thought that European recovery in general will lead to an increase in chemical exports from such countries as Norway, Belgium and Italy. It is also thought likely that erection of petroleum refineries in the Low Countries and electricity generation projects in various continental countries under the European recovery plans will eventually lead to the establishment of new chemical industries which will look for the world market for an outlet for at least part of their output.

### African Chemical Firm Expands Capital

KIMBERLEY — DeBeers Industrial Corp. Ltd. has increased its capital from $24 million to $28 million by the issue of one million new ordinary shares at $4 par to be issued to shareholders in the ratio of one new share to every four shares held.

The capital is being increased with a view to the possibility of further op-



# TAKES THE "SHAKES" OUT OF AIR LINES

**Penflex Flexible Metallic Hose prevents vibrations on compressed air lines, easily... safely... economically**

With a mighty roar, 15 diesel-powered air compressors pump a steady air supply for air tools and equipment used on a world-known project. During the installation of these powerful compressor units, a method was required to prevent constant vibration from being transmitted to the rigid air lines.

That's where Penflex "Flexineering" service paid off. By using 3" Penflex interlocked flexible metal hose as connectors between compressors and pipe lines, the "shakes" are eliminated. Tight as a pipe, but flexible, Penflex hose "soaks up" constant vibration, assuring smooth air power . . . leak-proof, low-cost service. Penflex hose is also used to carry off obnoxious diesel exhaust, preventing dangerous leaks and vibration.

When your plant is troubled with flexible tubing problems, whether they pertain to production, maintenance or high operating costs, let Penflex "Flexineering" find the right answer. As America's oldest manufacturer of flexible hose, Penflex offers helpful layout-design service on flexible tubing applications to all industries. For flexible metallic hose, tubing, or couplings from ⅛" I.D. and up . . . for handy, time-saving automatic barrel fillers and pneumatic rivet passers . . . for the finest in engineering service, call on Penflex. Write today, to . . .

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**7234 Powers Lane** **Philadelphia 42, Pa.**

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*In Gale or Storm*

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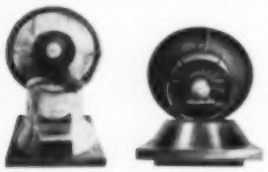
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**GREATER AIR DISCHARGE PER H.P.**

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portunities occurring of profitable investment of capital monies in African Explosives and Chemical Industries in which DeBeers hold half the ordinary share capital.

### French Chemical Industry Steps Up Production

PARIS—The French chemical industry is leading the postwar race for increased production. The index of chemical production has reached 140 percent of 1938 output while the general index for French industrial production is a bare 20 percent higher than prewar.

But even this production falls far short of satisfying France's needs. It is planned to boost output of most basic chemicals from 40 percent to 100 percent by 1952 with Marshall Plan aid. The accompanying table shows the breakdown of major planned production increases in metric tons:

A total of 170 billion francs (about $570 million) worth of new capital investments will be needed over the next four years to reach these production goals. This development program is too big for the industry to handle alone. Three years of postwar inflation have dried up credit to a trickle in France.

Consequently the chemical industry is looking to the European Recovery Program for a lot of help in financing its program.

So far the chemical industry hasn't received any Marshall aid to speak of. Biggest grant was 300 million francs (about a million dollars) to help finance a synthetic ammonia plant. But the industry is scheduled to get a bigger slice of dollar aid in the years to come. Ammonia and fertilizer production have been given a priority call on Marshall dollars since they are keys to the ambitious French program for agricultural development.

In addition to the problem of

**French Chemical Balance**

| | Production Capacity 1948 | Production 1947 | Needs 1952 | Anticipated Production 1952 |
|---|---|---|---|---|
| Ammonia | 210,000 | 161,000 | 570,000 | 400,000 |
| Sulphuric acid | 1,489,000 | 1,054,000 | 2,000,000 | 2,000,000 |
| Calcium carbide | 200,000 | 150,000 | 500,000 | 325,000 |
| Sodium carbonate | 600,000 | 600,000 | 750,000 | 750,000 |
| Chlorine | 75,000 | 58,000 | 150,000 | 150,000 |
| Dyes | 20,000 | 15,000 | 32,000 | 32,000 |
| Plastics | 30,000 | 22,500 | 120,000 | 120,000 |


**BOWEN No. 4 SPRAY DRYER**

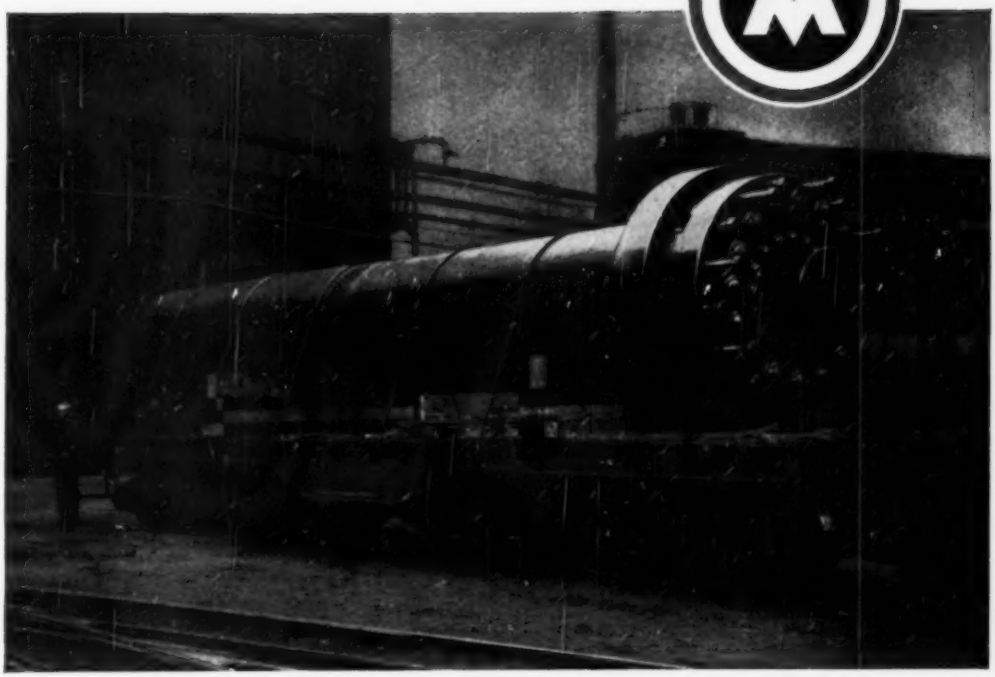
*...new unit for moderate scale production*

This compact Spray Dryer has the operating flexibility found in Bowen custom-made dryers, yet is available as a package unit. Production is 5 to 20 tons per day—automatically controlled. Patented Bowen atomizers for fine or coarse particles, driven by Bowen Spray Machines with speed range of 6,000 to 20,000 rpm. Factual data available.



BOWEN

**BOWEN ENGINEERING**
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## CUSTOM MADE PRESSURE VESSEL

Built for dependable performance, this one-piece, hollow forged giant will successfully resist high pressures, high temperatures and corrosive attack. This job—as with all Midvale work—had the careful attention of Midvale metallurgists and engineers from original design to loaded flatcar. Your own requirements for such vessels become our entire responsibility the moment you tell us what they must do. The Midvale Company, Nicetown, Philadelphia.

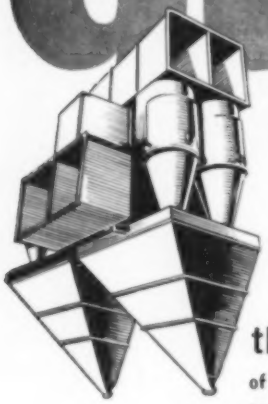
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of maintenance costs won't add up to a costly dollar-pool, if your dust recovery system is custom-engineered by Buell. The large-diameter cyclones won't interrupt your operation by clogging. Individual inlets to each cyclone insure even distribution of dust-laden gas. The utter simplicity of a Buell cyclone prevents costly operating complications. With all this, the patented van Tongeren 'shave-off' makes operating efficiency surprisingly high. The money-saving facts are all in the new 32-page catalog. Write: Buell Engineering Co., 18 Cedar Street, New York 5, N. Y.

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financing its investment program, the French chemical industry is confronted with three other serious obstacles: (1) A continuing shortage of imported raw materials due to the French dollar shortage. (2) Inadequate facilities for training new technicians. (3) A critical shortage of electric power resulting from the combination of Communist led strikes and protracted dry weather last year. All three of these bottlenecks are slowly being eliminated.

### Transportation Problems Holds up Fertilizer Output

MYSORE—Renovation of the ammonia and ammonium sulphate plant of Mysore Chemicals & Fertilizers Ltd. at a cost of $350,000, and expansion of the superphosphate production to 10,000 long tons at a cost of $250,000, are under consideration of the company's directors, while a proposed doubling of ammonia capacity has been shelved due to abnormal rises in the cost of equipment which would have made the step cost nearly $1,350,000.

Mysore Chemicals, India's smallest ammonium sulphate plant, usually produces some 5,000 long tons a year but 1947-48 production fell by more than 1,000 long tons because of transport and raw materials problems.

Currently, the labor force has been on strike for three months. Its demands would be eye-openers for western industrialists: a 50 percent pay raise, an annual bonus regardless of profits, and earmarking of 40 percent of profits for the workers.

### Argentina Linseed Oil Stocks Tax Storage Space

BUENOS AIRES—It is now estimated that the present crop of linseed will add 122,000 tons of oil to Argentina's present vast supply of some 278,000 tons which already tax her storage space. Allowing 30,000 tons of oil for domestic needs for the coming year, this will give Argentina a surplus stock of 362,000 tons of linseed oil.

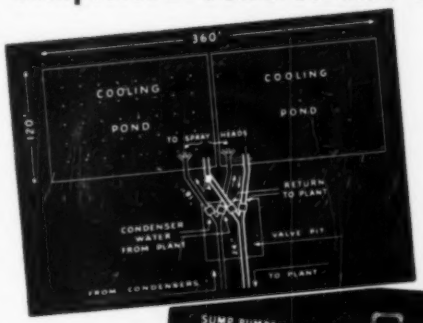
### Monsanto to Make Polystyrene in U.K.

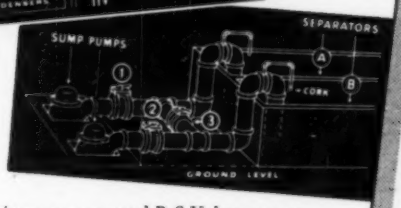
LONDON—Monsanto Chemicals Ltd. is well advanced in plans to manufacture polystyrene in Great Britain, it was disclosed by the company's managing director, E. A. O'Neal, Jr. speaking at the recent dinner of the Institution of the Rubber Industry. In the United States, according to Mr. O'Neal, all surplus plant previously devoted to the manufacture of styrene for buna S. rubber and now made idle by the con-

# R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •

## Simplified Control and Shut-Off




Four 18-inch electric motor operated R-S Valves are controlled by manual switches from the power plant in the condenser water cooling pond installation. This arrangement permits the use of one or both cooling ponds or the draining of either or both.

In the illustration of sump pump discharge, the plant sewer lines drain into the sump where the waste is pumped into concrete separators through R-S Valves 1 and 2. Valve 3 in the connecting line provides a means of cleaning either A or B separators as the ¾ inch syphon breakers can be plugged with corks and the fluid syphoned from the separators to facilitate cleaning operations.

50-pound R-S Iron Valves are utilized in both of these installations. They are designed for rugged hydraulic service with a large safety factor for line stresses, water hammer, and other abuses. Available with 25-pound or 125-pound American Standard flanges, the usual four types of manual control or power controlled prime movers of various types. Furnished in any metal that can be cast or welded including steel with Series 15, 150-pound American Standard flanges.

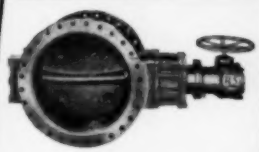
The angular seating disc gives wedge-type closure. For positive 100% shut-off, these valves can be fitted with the renewable, replaceable R-S patented rubber spool.

Consult the R-S representative in your locality. His experience can be extremely helpful. You will find the address and phone number listed under "R-S Products Corporation, Valves."

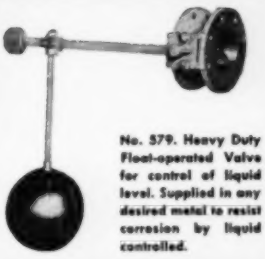
**R-S Products Corporation, Wayne Junction, Philadelphia 44, Pa.**



**R-S Duplex Strainer. 2½ turns of single handwheel permits alternate removal of identical basket strainers without interruption to flow. Valve controls strained water only resulting in reduced corrosion.**



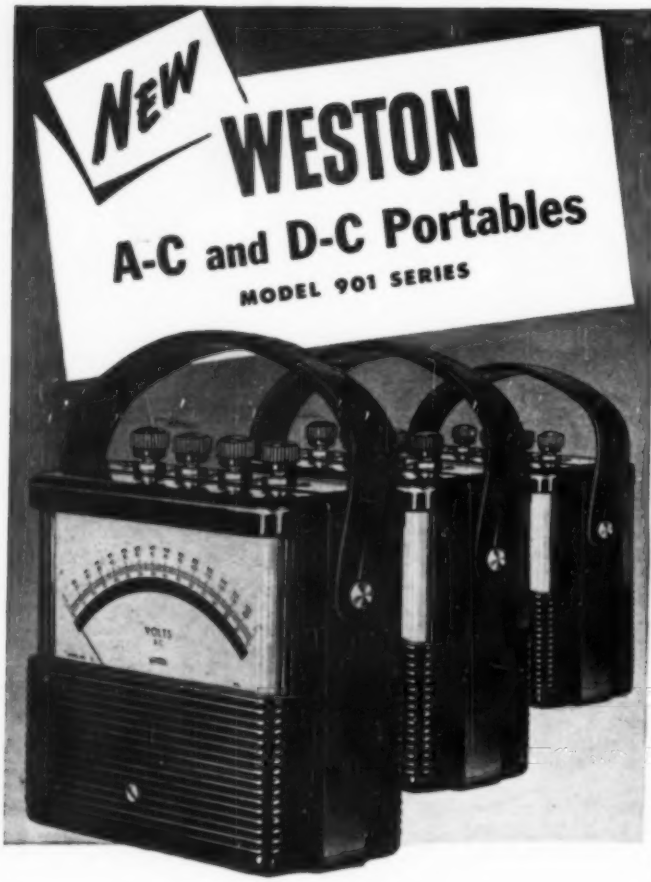
**No. 709. 50-pound Cast Iron Valve can be equipped with rubber spool for positive shut-off. Heavy duty handwheel control. Taper pins in vane are for positioning only; vane is keyed to shaft.**



**No. 579. Heavy Duty Float-operated Valve for control of liquid level. Supplied in any desired metal to resist corrosion by liquid controlled.**



**No. 602. 24-inch 150-pound Cast Steel Valve with Series 15 raised face flanges, air-cylinder positioner, handwheel and declutching unit. Constant 90° angularity between prime mover and valve stem. Controls liquids or gases.**




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version to natural rubber had been fully employed for the manufacture of styrene for polystyrene. At first styrene monomer will be imported from the United States but will be supplied later from the plants scheduled for the manufacture of monomeric styrene in Britain.

### Enka Interests Will Erect Italian Elastic Yarn Unit

NAPLES—An Italo-Dutch combine, connected with the Enka Co. of Holland, has decided to put up a plant in Naples to produce an elastic yarn, said to be a new process discovered at the Enka home factories involving the use of raw rubber. Enka has been given permission by the Italian government to import raw rubber into the country duty-free.

### Urea Formaldehyde Resins For Wood Preservation

NEW DELHI—The Forest Research Institute, Dehra Dun, has been carrying out experiments on the improvement of wood by impregnation with urea-formaldehyde resin forming systems.

The results, just published, show that it is possible to improve the strength properties of wood by such treatments. This increase however, was not found to be as great as with phenol-formaldehyde resins. The treatment was found to afford protection against nitric acid but not against alkali. The process suffers from the same disadvantage as the impregnation with phenolic resins in that it is not easily applicable to all types and sizes of timber.

It has the further disadvantage of high sensitivity to changes in hydrogen ion concentration of the treating solution. However, it may be suitable for a few specialized cases, especially where light colored articles are required.

### Canada Gets New Phthalic Anhydride Plant

OTTAWA—It is understood that three new production units of the Dominion Tar & Chemical Co., of Canada will come into operation shortly, including new and expanded facilities for phthalic anhydride and naphthalene production at Toronto; Dominion Alkali & Chemical Co., wholly owned subsidiary of the company, expects to bring its new chlorine and caustic soda plant into production at Beauharnois; Prairie Salt Co., another wholly owned subsidiary, expects to have its salt plant at Unity, Sask., completed in approximately two months or less, with



**For Calcining Petroleum Coke**—The installation of a large rotary kiln is always a man-size job and the accompanying illustration gives an idea of how it was accomplished at a well-known mid-western processing plant. The Vulcan kiln, especially designed and equipped for calcining petroleum coke is 10'-6" in diameter and 180 ft. long—of all-welded steel-plate construction, properly reinforced at points of greatest strain. A relatively large Vulcan rotary cooler of equally modern construction was installed, later, in the usual position underneath the discharge end of the kiln.

# *Vulcan Rotary Kilns are backed by a*

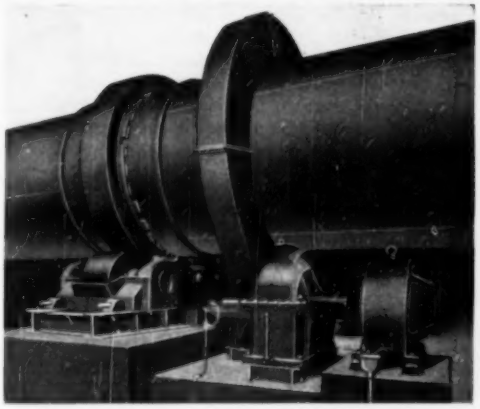
# HUNDRED YEARS

## *of Successful Manufacturing Experience*

Not many manufacturing companies in this country have operated continuously and successfully for a hundred years. That the Vulcan Iron Works has achieved this distinction is, in itself, an indication of uniformly high standards in both the design and construction of its many products for users of heavy industrial equipment.

For more than fifty years we have furnished a constantly increasing variety of Rotary Kilns, Coolers, Dryers, Retorts, etc., to the rock products, metallurgical and chemical processing industries; practically all of which have been designed and built especially to meet the purchaser's specific requirements. The experience thereby acquired is always at the disposal of prospective purchasers and often enables us to make money-saving suggestions without charge or obligation.

Write us regarding any processing requirement to which a rotary cylinder of any size or type might be applied. Our engineers welcome opportunities to cooperate with other engineers, or production executives, in developing designs that assure maximum efficiency at lowest ultimate expense.



Driving mechanism for Vulcan rotary kiln. Cast-steel gear ring and main pinion have machine-cut teeth and are completely enclosed in an oil-tight safety guard. Motor-driven speed-reducer drive unit is fully enclosed and operates in an oil bath.

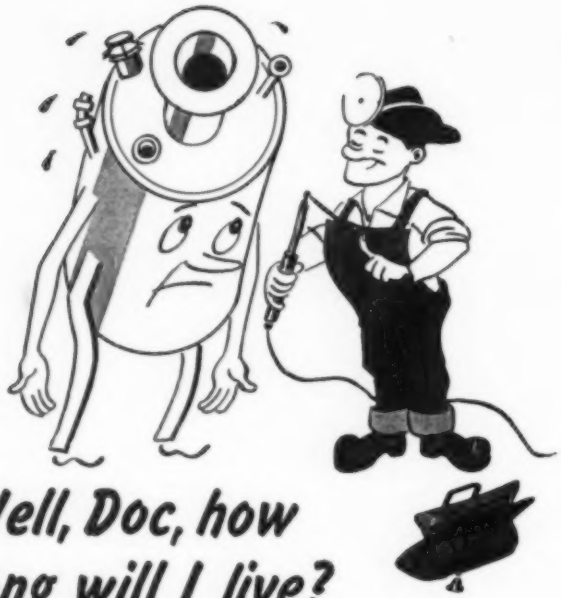
# Vulcan Iron Works

Established 1849

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The service life of your stainless steel processing equipment is determined by your fabricator. In the professional skill of his mechanics, welders and craftsmen lies the answer to the useful life of that equipment.

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CORROSION RESISTANT PROCESSING EQUIPMENT



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this plant having a capacity of approximately 125 tons of salt daily. When these three units are in production, the Dominion Tar & Chemical Co. will have largely completed a $6.4 million expansion program started about two years ago.

### Progress Reported in New Canadian $TiO_2$ Industry

OTTAWA—With titanium uses growing in industry, Canadian chemical engineers are watching with keen interest the progress being made in the huge titanium undertaking which the recently incorporated Quebec Iron & Titanium Corp., a joint enterprise of the Kennecott Copper Corp. and the New Jersey Zinc Co., is starting at Lake Allard about 400 mi. northeast of Quebec since extensive diamond drilling and tests have shown that the deposit there has more than 100 million tons of ore or enough to make Canada the world's greatest producer of titanium. The undertaking is estimated to cost approximately $25 million and is being financed privately by the Kennecott Copper and New Jersey Zinc on a 70 percent-30 percent basis respectively.

The latest progress report indicates that the 27-mi. Romaine railway line from Havre St. Pierre to Lake Allard has been started and it is now expected that the line will be completed late next year at a cost of between $8 and $10 million, enabling heavy equipment to be brought into this Canadian territory for open-pit mining operations. In addition, the ground has been broken on the site where the big refinery will be built in Sorel, Quebec, and this is expected to be completed as soon as possible. This plant will be able to handle 1,500 tons of titanium ore daily and an output of about 225,000 tons of titanium oxide slag and 175,000 tons of high-grade pig iron annually, with tentative plans already made to expand this plant just as soon as production is started.

Recently speaking on titanium and the Lake Allard deposit, W. P. Hammond, associated with Kennecott Copper Corp.'s exploration in Canada, stated in part that the titanium industry today stands at about the same class as the nickel industry before the turn of the century; its potentialities barely scratched and with vastly expanding possibilities for future use. In the immediate future the most important use for the Allard Lake ores will be for the production of titanium white.

Surface geology and diamond drilling carried out on the main $TiO_2$ deposit at Allard Lake shows that the ore zone is 3,600 ft. in maximum

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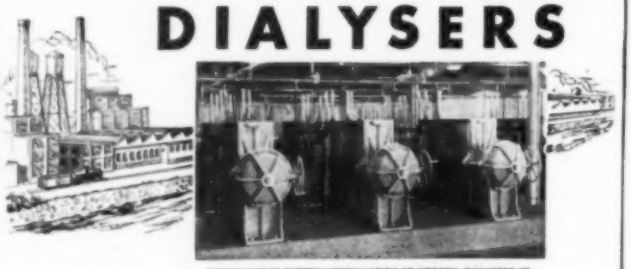



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Industries employing certain liquid solutions in their process are confronted with the problem of stream pollution in the disposal of waste. Dialysis may be the solution for you, as it has for others, to a low cost method of preventing stream pollution —plus the saving of the cost of a neutralizing agent and a profit from waste through recovery.

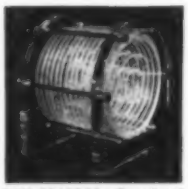
**The process is now in profitable operation in many fields for the:**

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REMOVAL OF ACIDS, ALKALIS OR OTHER NON-WANTED MATERIALS

PURIFICATION OF SOLUTIONS

MANUFACTURE OF BY-PRODUCTS



MADE OF LUCITE — The action of transfer and separation can be clearly seen throughout the experiment

**LABORATORY MODEL**

Colleges, Universities and Research Laboratories are now using the Webcell Laboratory Model for the study of dialysis and are conducting experiments in Recovery, Removal, Purification and Separation of solutions. The results obtained can be closely translated into terms of the expectancy from the larger production units.

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length, 3,400 ft. in maximum width and covers 134 acres. The $TiO_2$ zone is divided into the main ore body and the Cliff ore body; but greatest possibilities lie in the main ore body where considerable depth has been attained.

Initial mining operations will be carried out on the Cliff ore body where detailed drilling has established one million tons of ore. In the main ore body there are more than 120 million tons of indicated ore. On the basis of drilling results and samples the average grade of ore is 32 percent $TiO_2$ and 36 percent Fe. Waste and lower grade sections are distributed in such a way as to present no serious mining problems.

### India Searching For New Gypsum Sources

BOMBAY—Prospecting for gypsum to feed the Indian government's 350,000 long-ton-a-year ammonium sulphate fertilizer factory in Bihar has turned up promising deposits in Bikaner and Jodhpur in the Rajputana area. Meanwhile, further prospecting is planned in the Cutch and Kathiawar areas. An assured source of gypsum from within India is sought, as the Khewra field on which the factory was to draw passed to Pakistan as a result of the partition of India.

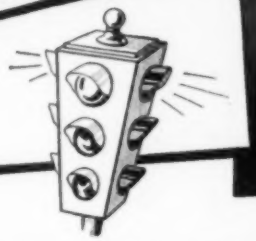
### New Treatment for Low Grade Chrome Ore

MELBOURNE — The Commonwealth Council for Scientific and Industrial Research has developed a process for production of chronic anhydride primarily from low-grade Australian chrome ore, but advantageously applicable to the treatment of high-grade ore.

A pilot plant has been in operation in the Council's Fishermen's Bend Laboratories for several years and the process is now considered ready for industrial application. Several Australian firms are considering to adopt the process commercially.

As a first step in the treatment, chromite ore is digested for 4 hr. at 140 to 160 deg. C. with three times the theoretical quantity of 75 percent sulphuric acid required to dissolve the constituents of the ore, with 10 percent of $CrO_3$ (calculated on the weight of the ore) added as catalyst. The volume of the resultant solution, called "green liquor," is increased 50 percent by addition of cold water and the undigested ore and silica removed by centrifuging. The filtered "green liquor" is diluted to 45 grams $Cr_2O_3$ per liter and oxidized to 95 percent completion in diaphragm type cells,

# STOP STREAM POLLUTION... *Automatically*





***Bristol's pH Controller-Recorder puts plant waste neutralization on continuous, accurate, economical basis***

If you are now neutralizing plant wastes manually —or are considering the installation of a neutralization system, a Bristol pH ControllerRecorder can standardize your results . . . prevent corrosion losses . . . utilize chemicals with maximum economy and safeguard stream and river purity.

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using lead anodes with lead peroxide layers, at a current density of 20 amp. per sq. ft. The current efficiency is 50 to 60 percent.

The oxidized solution, called "red liquor," is then evaporated to 750-780 g. of $SO_4$ ion per l. at approximately 130 deg. C., stirred and cooled for 12 hr., and the resulting slurry filtered and washed with 60 percent $H_2SO_4$. If a filter press is used, the wash acid is saturated with sulphate cake from a previous filtration to prevent "channeling" through the cakes in the press during washing. The filter cake contains sulphates of iron, aluminum and magnesium.

Filtered red liquor is then evaporated to 150-160 deg. C., depending on the amount of $CrO_3$ required for the subsequent digestion, cooled to 25-30 deg. C. and filtered in a centrifuge through 100-mesh stainless steel gauze. The resulting product contains approximately 91 percent $CrO_3$, 2 percent $H_2SO_4$, traces of metallic elements, and water. Further purification is possible by either washing with saturated $CrO_3$ solution or by spraying the cake in the centrifuge with a minimum quantity of water. The product then contains approximately 95 percent $CrO_3$, traces of $SO_4$ ion and water.

Recovered acid is then used for the next digestion, with the required amount of $CrO_3$ and $H_2SO_4$ added. The process has been operated through 12 cycles without discarding the acid. An over-all yield of 75 percent of the Cr in the ore is obtained in the pilot plant.

The above information was obtained by McGraw-Hill World News through the courtesy of Mr. I. W. Wark, Chief of the Division of Industrial Chemistry, Council for Scientific and Industrial Research.

## India Again Allows Dyestuffs Exports

NEW DELHI—The government of India has decided to permit export of dyestuffs, imported from soft currency areas, in reasonable quantities to Pakistan by (1) dealers possessing trading licenses issued by the Textile Commissioner prior to partition and who have established organizations to sell dyestuffs in Pakistan, and (2) importers who are sole agents for India and Pakistan of exporters abroad and who possess and repack imported dyestuffs for distribution in the areas now covered by Pakistan.

Applications supported by documentary evidence should be made to the Export Trade Control authorities at the Ports and the Export Trade Controller, Armitsar, for consideration. No



**Straight-Flow Port Design** reduces fluid turbulence to a practical minimum.



**Seat Rings** of end-seated type are screwed into the body.



**Sure-Grip Malleable Handwheel** for non-skid gripping even with heavy gloves.

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# iron body gate valves

**with screwed or flanged ends**




## ... 8 Outstanding Features

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**WALWORTH**

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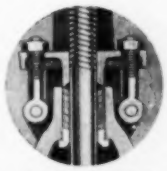
**T-head Disc-to-Stem** connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.



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*FOR CRUSHING CRUDE MATERIAL*

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● No matter what the job requires, there is a standard Williams machine for the reduction requirements. Capacities range from 50 pounds to 300 tons per hour, permitting selection of exactly the proper size for your work.

The "Slugger" Type shown above is ideal for the primary reduction of crude ores, etc. Crushes by the Williams Hammer Principle, with rows of heavy, free swinging, fast revolving hammers crushing the material by impact until of proper size to pass through the grates. The ideal machine for the job.

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applications will be entertained by the Chief Controller of Exports, New Delhi, direct. Parties who have applied previously should renew their applications if they are eligible.

### Argentina Regulates Alcohol Consumption Pattern

BUENOS AIRES—The Argentine government has ruled that all alcohol distilleries must deliver 60 percent of their production for denaturalization of which 80 percent must be devoted to fuel alcohol. Sugar cane molasses, previously reserved for distillation of alcohol, may now be used in manufacture of emery stones and in iron or steel foundries.

The government has also asked that those interested in the import of calcium and sulphur for 1949 present their requirements to the Department of Industry and Commerce.

### Canada's Chemical Exports Slow up in 1948

OTTAWA—Canadian exports of chemicals and allied products dropped to $6,498,000 in November 1948 compared with $6,720,000 in the same month of the previous year and declined to a total of $73,812,000 in the first eleven months of 1948 as against $76,641,000 in the corresponding period of the preceding year, according to the latest report of the Canadian Government.

### Indian Firm Spending Nearly $2 Million on Expansion

CALCUTTA—Alkali & Chemical Corp. of India Ltd., important Indian producer, is spending nearly $2,000,000 on extensions to its works near here. Design work has been started on an extension to the chlorine plant which will boost production, now rated at 1,500 long tons per year, to 4,150 long tons a year by 1951. In addition a plant to manufacture benzene hexachloride dust from imported crude benzene hexachloride and a plant for the manufacture of hydrochloric acid using chlorine and hydrogen from the chlorine plant are under way. Both should be operating before the end of 1949. Imperial Chemical Industries Ltd. is technical adviser to the company.

### Australian Industry Starved For Base Metals

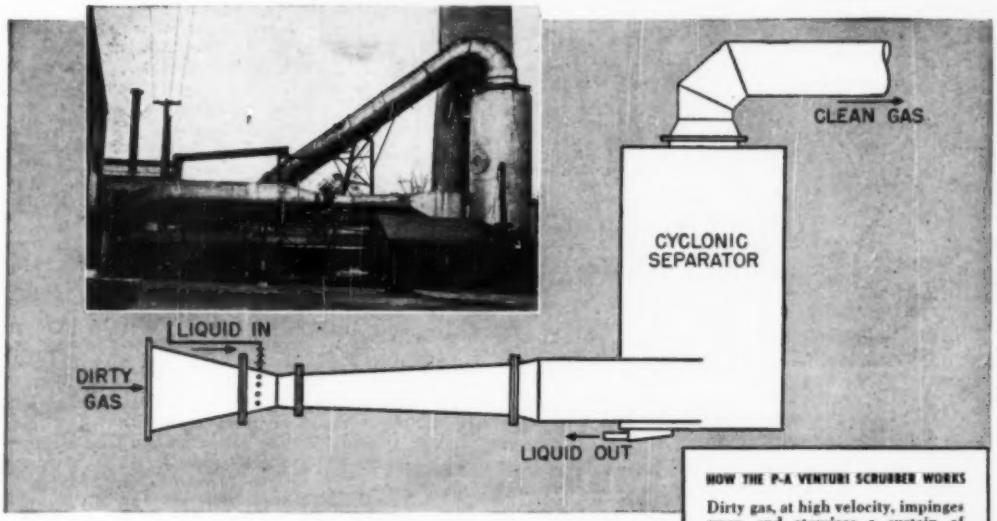
MELBOURNE—Australia's government policy to fix domestic selling prices of base metals at a fraction of international parity has precipitated a crisis

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**( A PEASE-ANTHONY DEVELOPMENT )**




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Dirty gas, at high velocity, impinges upon and atomizes a curtain of liquid introduced through jets at the throat of the Venturi. Differential velocities of gas and atomized liquid result in collision of mist or dust particles with liquid droplets. The coalescence of mist or agglomeration of dust resulting from this collision makes simple cyclonic separation possible.

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**ADVANTAGES: Highly efficient**—Assures virtually complete removal even of sub-micron dust and mist.

**Low initial cost**—The first cost of the P-A Venturi Scrubber is considerably less than other equipment of equivalent performance.

**Low Maintenance** — Its maintenance cost is less than that of other equipment of equivalent performance.

**Low Water Requirement** — Requires generally less water (or scrubbing liquid) than other liquid scrubbers.

**Can Handle Gas At Any Temperature**—Pilot Plant tests show no difficulties even at 1800° F. Actual installations now operating at 700° to 800° F.

**More Compact and Lighter**—It requires less space and is lighter in weight than other equipment of equivalent performance.

**Simple and Safe to Operate and Maintain**—Any competent maintenance man can service a P-A Venturi Scrubber. No special skill is needed to repair equipment.

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V-4


which threatens to engulf an important new chemical industry. State and federal authorities have promised action to rectify the anomaly.

Producers of lead and zinc are compelled to supply the domestic market below cost and to look for profits in overseas markets where they get the ruling international price. Mining concerns have met the situation by exporting increasing amounts of metal equivalents in unsmelted concentrates, thus saving their refinery associates from losses. Established industrial users of zinc and lead can obtain only a portion of their requirements. Some metal-using plants have been shut down.

A new chemical industry, Euston Lead (Australia) Ltd. has got off to a bad start in this crisis. The firm was established a year ago to produce 7,000 tons of white lead (basic lead carbonate) annually under franchise to the Glidden Company. The franchise gives Euston exclusive sales rights on this pigment for Australia, New Zealand and contiguous territories. The requisite annual intake of 6,000 tons of refined lead makes Euston potentially the biggest user in Australia. But unless the official Australian lead price is raised to make domestic sales more attractive to Broken Hill Associated Smelters (the only refinery that does business in the Australian market), Euston will be without lead when the factory is ready to swing into production next April.

The Australian lead price is pegged at slightly above 3c. per lb., compared with an international price of 25c.

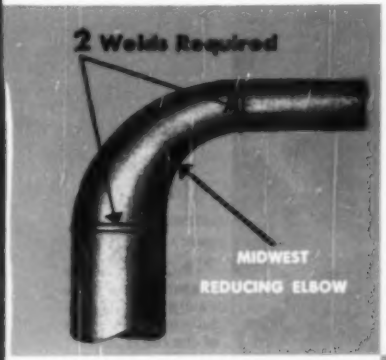
### Norton Builds New Abrasives Plant in Canada

OTTAWA — Representing increasing product demand and expanding operations in Canada, Norton Co. of Worcester, Mass., will open an abrasives manufacturing plant at Cap de la Madeleine, Que., with the company purchasing the plant of Durham Chemicals Co. of Canada, the latter company continuing operations there on a reduced scale. Approximately $1 million will be spent on alterations on the plant and it is estimated that some 1,000 electric hp. will be required.

### Netherlands Gets New Detergent Plant

AMSTERDAM—The Royal Dutch Petroleum Co.'s large synthetic detergent (Teepol) plant near Rotterdam will start operations this month. Its huge plastic plant near Rotterdam will be opened in a few months.

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The Midwest Reducing Elbow saves more than a third of the welding when used instead of a standard elbow and reducer. In addition to a substantial saving in time and money, it provides much neater appearance and insulation is easier. The gradual reduction, smooth curve and absence of abrupt neck reduce the pressure drop and turbulence. Center-to-end dimensions are the same as for ASA standard elbows.

All the advantages of Midwest Standard Elbows are to be found in Midwest Reducing Elbows . . . unusual dimensional accuracy and uniformity, stress relieving, beneficial effect of working metal in compression, etc.

The Midwest Reducing Elbow is only one of many fittings developed by Midwest to reduce the cost and improve the quality of welded piping. You will find it advantageous to get in touch with the Midwest Distributor near you whenever you need welding fittings.

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Improve Piping Designs and Reduce Costs




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Chicago (3), 79 West Monroe St. • Los Angeles (33), 520 Anderson St. • Houston (2), 229 Shell Bldg. • Tulsa (3), 533 Mayo Bldg. • South Boston (27), 426 First St. • Distributors in Principal Cities.

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1. Thoroughly mix "National" cement with "National" accelerator in recommended proportions.



2. Pour part of the mixture onto a table and work it carefully into the threads of the collar...



3. Then work mixture into pipe threads...




4. Screw collar firmly in place and wipe off excess cement with acetone... the resulting joint is as strong and impervious as the pipe itself!

## KEEP "KARBATE" PIPE ALWAYS IN STOCK!

- Resists the action of acids, alkalies and other chemicals
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- Easy to machine and install
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# THE CORROSION FORUM

*Edmond C. Feller,* ASSISTANT EDITOR

# Hydrochloric Acid versus Construction Materials

Part IV of a four-part symposium in which a representative group of construction materials are evaluated for services involving hydrochloric acid.

## CHEMICAL STONEWARE

F. E. HERSTEIN
*General Ceramics and Steatite Corp.*
*Keasbey, N. J.*

THE MANUFACTURE and handling of hydrochloric acid represents one of the widest applications for chemical stoneware equipment. From a historical point of view, muriatic acid was first manufcatured in stoneware stills by the alchemists during medieval times. The first commercial methods for manufacturing hydrochloric acid during the 18th century employed chemical stoneware towers and vessels.

In regard to corrosion resistance, chemical stoneware is completely inert to hydrochloric acid at all concentrations and at all temperatures normally encountered in its manufacture and handling. Ceramic ware is, in fact, among the very few materials of construction that will withstand these conditions.

In the manufacture of hydrochloric acid, chemical stoneware is used both for complete plants and for units of plants made up in combination with other materials of construction. The classical method of manufacturing hydrochloric acid utilizes chemical stoneware towers through which gas passes and is absorbed by means of liquid airlifts. Tourills, a type of absorption vessel, are also widely used for this purpose. There are many types of tourills, the most common being the Meyer, which is an oblong vessel with outlets at both ends at the top, and the Cellarius, which is saddle shaped with outlets also at the top. These are installed in trains with stoneware interconnecting U-bends.

The main disadvantage in the use of stoneware for hydrochloric acid absorption is its comparatively low heat transfer. This has been obviated to some extent by the development of high heat transfer bodies with a high silicon carbide content. However, hydrochloric acid absorption systems are very frequently designed using other materials of construction such as impregnated graphite, tantalum and thin walled glass tubing for the heat exchange surface, and chemical stoneware for the main body of the apparatus. This type of absorption system is very common at the present time and one example is a plate tower in which the plates are of impregnated graphite and the top and bottom of the tower and circulating parts of the system are of chemical stoneware.

Besides being used in the manufacture, chemical stoneware is widely used in the handling of hydrochloric acid. Chemical stoneware storage systems made up of a battery of stoneware vessels have found use in this field. Piping and fittings are used for the connections between storage systems and the ultimate use. These are available in all types and sizes.

Chemical stoneware pumps for handling muriatic acid are also widely used. The construction of these is such that the entire wet end of the pump is constructed of chemical stoneware to withstand corrosion and protected by armor to prevent damage from mechanical abuse. Chemical stoneware pumps delivering 1,000 gpm. of hydrochloric acid are at present available as stock equipment. Kettles and reaction vessels of capacities up to 350 gal. are used in reactions involving hydrochloric acid, and the chemical stoneware tower, either flanged or bell and spigot, is widely used for fume absorption and reaction problems.

In summation, it may be said that chemical stoneware is completely impervious to the attack of hydrochloric acid in all concentrations and temperatures and is widely used for both manufacturing and handling all of the familiar types of chemical process equipment being used for both of these applications.

## GLASS-LINED STEEL

S. W. McCANN,
The Pfaudler Co.
Rochester, N. Y.

UNDOUBTEDLY the most common application of glass-lined steel in the chemical industry is in those services where hydrochloric acid is encountered over a broad range of concentrations, temperatures and pressures. The glass is fully resistant to hydrochloric acid both wet and dry at all concentrations and temperatures, and the steel to which the glass is applied can be fabricated into a wide variety of designs.

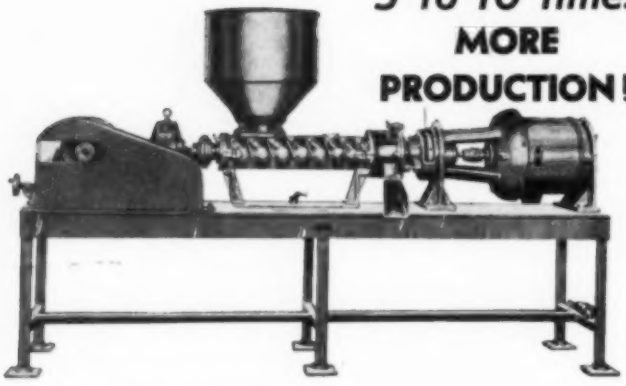
The most common design is that of jacketed reactors equipped with glass-covered agitators and baffles. These are built over a wide range of sizes and pressures to conform to ASME code requirements for unfired pressure vessels. Heat transfer is obtained through the jacketed portion of the reactors, accompanied with very effective agitation. The jackets can be used for steam, water or brine, and thus permit excellent temperature control as the reaction proceeds.

Other designs that are used in services involving hydrochloric acid are stills, condensers and receivers, either as individual units or complete distillation assemblies. The stills can be operated under pressure or vacuum, depending upon individual requirements. Condensers can be of either a thimble or cascade type. Crystallizers or evaporating dishes of shallow design are quite common. Storage tanks for hydrochloric acid in bulk are available in quite large sizes. Glass-lined

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valves and pumps are made in a variety of sizes for handling hydrochloric acid. Glass-lined steel pipe and fittings are widely used.

Typical services in which some of the designs given above are to be found are as follows: (1) Reactors of 3,500 gal. capacity and operating at 125 psi. internal pressure in the production of vinyl plastics. (2) Reactors of various sizes for the hydrolysis of proteins in strong hydrochloric acid at elevated temperature and pressure. (3) An unusually severe service successfully met in the petroleum industry for the production of hydrochloric acid from salt and sulphuric acid. (4) The manufacture of many biologicals and pharmaceuticals involves the presence of hydrochloric acid. Hence there is an extensive use of glass-lined steel in this service, in view of rigid requirements that metallic contamination be avoided.

## PROTECTIVE COATINGS*

WE HAVE run spot tests and immersion tests on many proprietary coatings in HCl, and have more difficulty in trying to secure results that check than with any other reagent. It isn't that HCl is peculiarly destructive to protective coatings or the materials from which protective coatings are concocted, but the fact that HCl seems to penetrate films or find imperfections

Resistance of Coatings to HCl

| | Days Protection† |
|---|---|
| Fedelco, Federal Elec. Co. | 80+ |
| Pencote, Peninsular Chem. Prods. | 80+ |
| Tygon, U. S. Stoneware | 78 |
| Nukemite, Nukem Prods. Corp. | 78 |
| NuType 150, Gregg Co. | 7+, 14+ |
| Carbozite, Carbozite Corp. | 14+ |
| Cocoon, R. M. Hollingshead Corp. | 14+ |
| Amercoat 44, Amer. Pipe and Constr. Co. | 3, 14+ |
| Prufcoat, Prufcoat Labs. Inc. | 3, 4, 14+ |
| Neolac, Chamberlain Eng. Corp. | 14 |
| Amercoat 33, Amer. Pipe and Constr. Co. | 12 |
| Amercoat 55, Amer. Pipe and Constr. Co. | 7 |
| CE9809, Sherwin Williams | 6, 7 |
| Korolon, Tycor Products | 4, 4, 7+ |
| Corrosite Black, Corrosite Corp. | 3, 4+ |
| Valdura Black, Amer. Marietta Co. | 3 |
| Sovaklor Gray, Socony Paint Prods. | 2 |
| Horn Black, A. C. Horn Co. | 2 |
| Corrosite Gray, Corrosite Corp. | 2 |
| Rubber Coat Black, Wilbur and Williams Corp. | 1 |
| Kromall, Monroe Sander Corp.<br>Sovaklor 28W502B, Socony Paint Prods.<br>Sanco Gray, Munroe Sander Corp. | Less than one day |

† More than one number after a coating means the coating was tested more than once; each number is for a separate test. The + after a number means the test was stopped after that number of days, but the coating was still furnishing protection.

* The author of this article is with a large chemical company which uses, but does not produce, protective coatings.

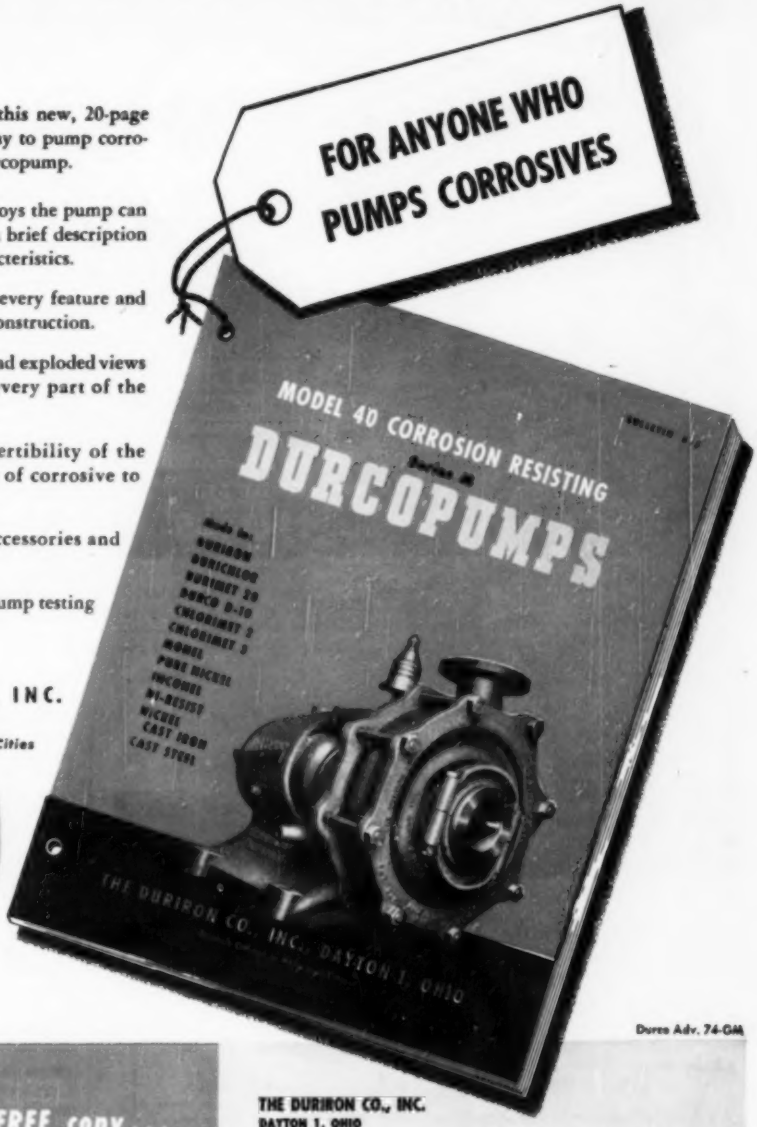
# An Important, New Booklet . . .

**Here are the facts about this new, 20-page booklet on the modern way to pump corrosives . . . the Model 40 Durcopump.**

- It tells what Durco alloys the pump can be built in and gives a brief description of their physical characteristics.
- It shows and explains every feature and detail of the pump's construction.
- By means of cutaway and exploded views it lets you examine every part of the design.
- It explains the convertibility of the pump from one type of corrosive to another.
- It has a chapter on accessories and modifications.
- It tells about Durco's pump testing procedure.

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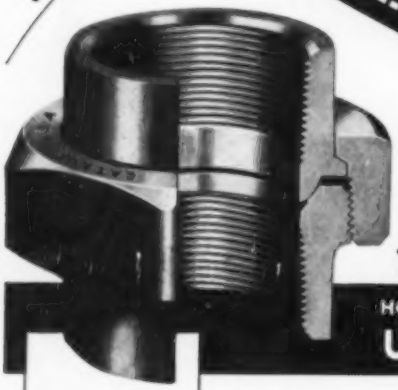
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PERFECT SEAL...



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STANDARD AND DOUBLE EXTRA HEAVY

HOT FORGED from solid, rectangular steel bars, Catawissa Pipe Unions are free from sand and blow holes. The ball-to-angle seat design plus their ability to expand and contract with the pipe give you sure fire dependability . . . a perfect seal for every application!

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very readily. The accompanying table showing tests on proprietary compounds does not give a very reliable indication of anticipated life of these protective coatings in HCl. However, because the other materials which are resistant to HCl are either quite expensive metals or have fabrication difficulties, such as with stoneware, glass, graphite or chemical enameled construction, some of these protective coatings are used in spite of their uncertainty.

### Baked Phenolic Coatings

Following is the text of a private communication to the author from Fred L. Sharpe, Jr., sales manager of General Coating Co., Woodbridge, N. J.: "Phenol-formaldehyde thermosetting (baked phenolic) synthetic resin coatings are not generally recommended in applications involving hydrochloric acid. A baked phenolic coating has the necessary resistance to withstand hydrochloric acid at room temperature but a perfect coating film entirely free from minute porosity is required due to the activity of this acid. It is, therefore, due to application hazards that baked phenolic coatings are not freely recommended for this type of service.

"However, baked phenolic coatings have been used successfully in applications where traces or small concentrations of hydrochloric acid are present. This type of coating has also been used in hydrochloric acid applications in instances where more expensive corrosion-resistant materials have a limited service period. In these cases it is usually more economical to replace or recoat the coated component periodically.

"The baked phenolic coating does represent an economical means of increasing equipment life in hydrochloric acid service but the user should not expect indefinite service from the coating.

"Regarding hydrochloric acid fumes, a baked phenolic coating can withstand a maximum concentration of approximately 200,000 ppm. at a maximum temperature of 80 deg. C."

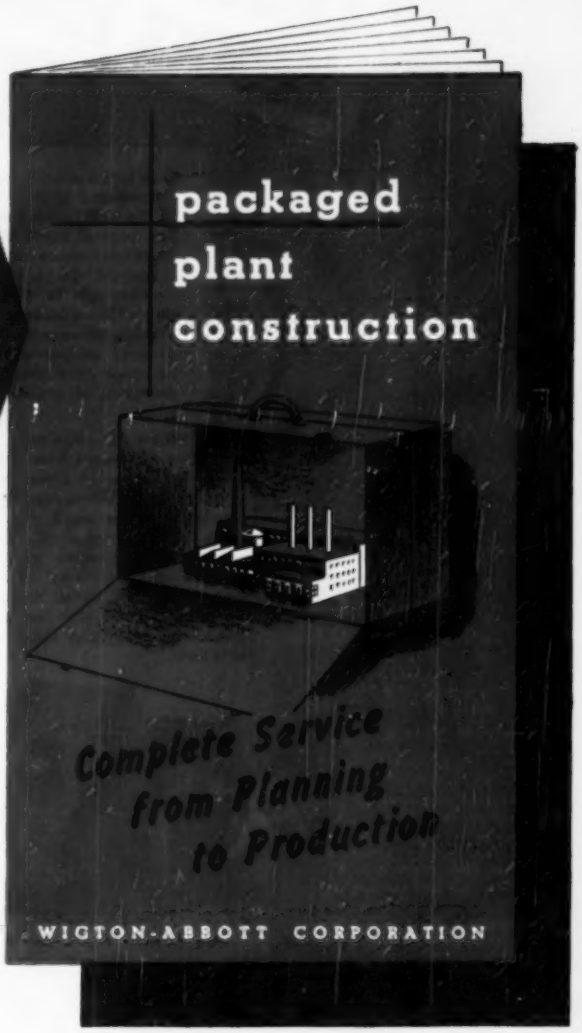
Next is the text of another private communication to the author—this one from Kenneth Tator, chemical engineer and corrosion consultant of Coraopolis, Pa.: "Most of the commonly used rubbers and synthetic organic linings are resistant to hydrochloric acid. Exceptions are the polysulphide rubbers and cellulose esters and ethers. Therefore selection of linings depends upon other service conditions, such as operating temperatures and probability of mechanical impact and injury. Cost is, of course, also an important consideration.

"Unlike corrosion resistant metals and alloys, organic coatings are inert

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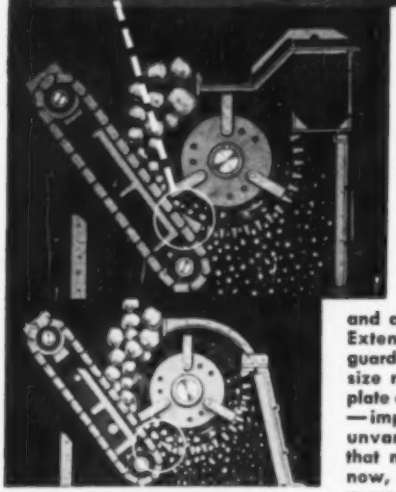

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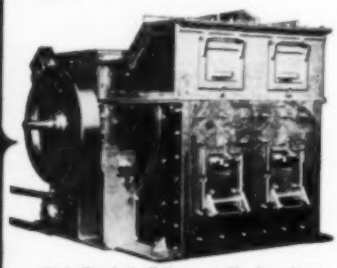
**Note by comparing before and after diagrams how the new, Extended Moving Breaker Plate guards against the passage of oversize material between the breaker plate and front cage bar. The result—improved grinding control for unvarying uniformity of product that makes the Dixie Hammermill now, more than ever before, your guarantee of greater production at less cost.**

## NEW! IMPROVED!

### DIXIE HAMMERMILL

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- 1. All-steel construction for greater strength . . . longer life
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- 4. Metal trap (optional) for facilitating removal of tramp iron.



Dixie "36 Series" Hammermills, for primary or secondary crushing, are built in 4 sizes in capacities ranging from 25 to 150 tons.

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barriers which, in the form of a lining, keep the corrosive out of contact with the corrodible structural metal of the equipment. Any imperfection in this barrier, caused either by faulty initial application or subsequent mechanical injury, will render the barrier ineffective and in some instances may even accelerate the corrosive action.

"Therefore in resisting highly corrosive acids such as hydrochloric, linings should be selected which can be applied without pinholes and which by form and characteristics will not be readily injured. Both of these requirements are most readily accomplished by avoiding all linings of less than ¼ in. in thickness and preferably selecting those with toughness and resilience. This recommendation immediately excludes the baked phenolics and all other air-dried or baked sprayed-on coatings even though these materials in themselves are inert to hydrochloric acid.

"This then leaves us with such materials as the rubbers, rubber-like vinyls, polyethylene, polystyrene, and vinylidene chloride.

"All of the rubbers are suitable if properly compounded by the manufacturers for hydrochloric acid service. Natural rubber, GR-S, neoprene, and butyl rubber are in extensive satisfactory use. Natural rubber on initial contact with hydrochloric acid forms a surface film of rubber hydrochloride which resists further absorption. The other rubbers do not form this secondary barrier but have sufficient resistance in themselves to be satisfactory linings. The rubbers should not be used without previous verification at temperatures above 180 deg. F. Neoprene may be safely used at temperatures up to 220 deg. F.

"The rubber-like vinyls, as sheet or deposited from plastisols, are all satisfactory provided they are adequately stabilized by the producer against decomposition to form HCl, which reaction may be accelerated by contact with hydrochloric acid. The vinyls should not be used continuously at temperatures in excess of 180 deg. F. without previous trial.

"Polyethylene, polystyrene and vinyldene chloride in sheet form are in quite extensive satisfactory use, but being thermoplastic should not be used for temperatures in excess of 170 deg. F. without prior trial."

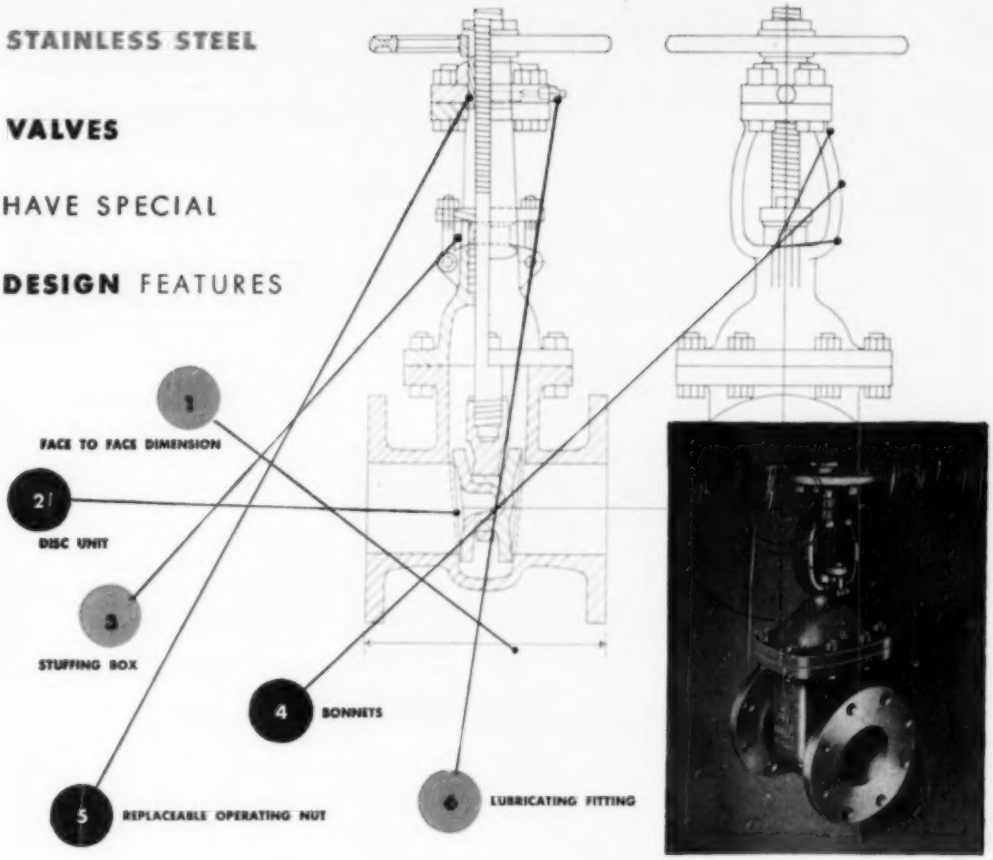
## CHEMICAL PORCELAIN


W. V. LAPP
Lapp Insulator Co.
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TRUE white chemical porcelain, completely vitrified and non-absorbent, is a highly satisfactory material for handling hydrochloric acid. Such

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**1. Face to face dimension** meets American Standards B-16-10-1939 enabling the replacement of valve in a line without cutting or disturbing that line. **2. Disc unit** adjusts itself to the seats in the valve body regardless of angle. Positive sealing insured on the upstream or downstream sides of the discs. **3. Stuffing box** is more adequate in depth to insure tightness and maximum packing life. **4. Bonnets** have the exclusive Cooper Alloy "Valves That Breathe" feature which compensates for expansion and contraction due to temperature changes without damaging the stem or operating nuts. **5. Replaceable operating nut** eliminates line shut down or breaking of Bonnet Joints. **6. Lubricating fitting** feeds lubricant to operating nut insuring ease of operation.



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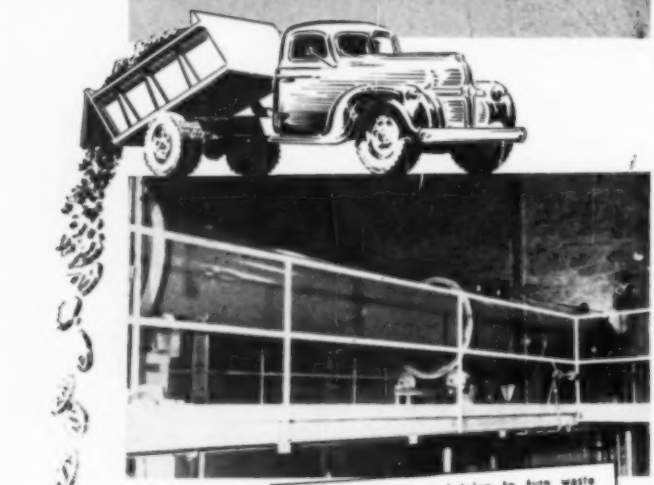
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Wheatland Tube Company and Wheatland Steel Products Company use vast quantities of pickle liquor in the manufacture of steel tubes and pipe couplings. Like most everyone else, Wheatland for years discarded the spent liquors—*and the valuable by-products they contained.*

But recently, after years of research, Wheatland engineers developed a successful process for utilizing pickling materials by reacting them with zinc by-products from the galvanizing department to produce ferric hydrate and the sulphate and chloride of zinc. Hersey equipment plays an important part in the operation: after the impurities have been removed and the ferric acid filtered out, zinc sulphate is crystallized, washed and then dried in a 3' Concurrent Flow Hersey Dryer specially constructed for the job. Handling 1000 lbs. an hour, this Hersey Dryer removes 94% of the free water from the crystals making them ready for immediate packaging without further processing.

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porcelain is widely used in the form of valves, plug cocks, pipe and fittings, raschig rings, and special apparatus such as towers, vessels, filters, ejectors and nozzles.

Chemical porcelain is unaffected by HCl in any concentration at any commercial operating temperature. This is true whether porcelain is glazed, unglazed or surface-ground.

Porcelain's limitation for handling HCl lies only in mechanical durability and availability of all shapes and sizes. It, like most other ceramics, glass, carbon and high silicon materials is relatively fragile and subject to breakage if abused. This breakage may occur from mechanical shock or strains or from sudden thermal changes which impose strains beyond the ability of the porcelain to absorb.

Vitrified chemical porcelain is a relatively dense and fine grained ceramic that lends itself to grinding to accurate dimensions and polishing to fine finish. It cannot be manufactured in as wide range of shapes and sizes as some other materials.

In summary, vitrified white porcelain, chemically, is an ideal material for handling HCl. Properly installed, and free from severe mechanical and thermal shocks and strains, it will provide trouble-free operation.

## NACE Announces Program

THESE are the papers to be presented at the national meeting of the National Association of Corrosion Engineers. As usual there will be an exhibition by manufacturers of their anti-corrosion products. Both the exhibit and the technical sessions will be held at the Netherland Plaza Hotel in Cincinnati, April 11-14.

**Corrosion Principles. April 11.**

"Why Metals Corrode," H. H. Uhlig, Massachusetts Institute of Technology.

"The High Temperature Corrosion of Metals," Hugh J. McDonald, Loyola University.

**Chemical Industry. April 12.**

"The Pulse Polarizer in Corrosion Technology," Glenn A. March, Pure Oil Co., and Hugh J. McDonald, Loyola University.

"Physical and Corrosion Characteristics of Lead in the Chemical Industry," Kempton H. Roll, Lead Industries Assn.

"Corrosion Tests in the Processing of Soap and Fatty Acids," W. Z. Friend and J. F. Mason, Jr., International Nickel Co.

"Plant Corrosion in the Fatty Acid Industry," R. J. Paul, Emery Industries, Inc.

**Electrical and Communications Industries. April 12.**

"Corrosion Protection of Power Transformers by Flow Coat Method," Siebert L. Miller, Union Electric Co. of Missouri.

"Corrosion Testing of Buried Cables," T. J. Maitland, American Telephone and Telegraph Co.

"Field Experience with Corrosion Protection of Galvanized Steel Substation Structures," Siebert L. Miller, Union Electric Co. of Missouri.

"Use of Dry Disk Rectifiers as Valves in Electrolysis Drainage Return Wire," W. D. Connon, Bell Telephone Co. of Pennsylvania.

**Cathodic Protection. April 13.**

"Electrolysis Experiences on 115 KV.

**To insure the efficiency of operation intended in the original design**

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A STAINLESS STEEL of the U·S·S 12 type was used by the A. O. Smith Corporation, Milwaukee, in this ¾" lining for a giant fractionating tower, 116 ft. long by 16 ft. in diameter, recently built for a Chicago area refinery.

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U·S·S Stainless Steels are available in a wide variety of analyses to meet practically any requirement of oil refinery service. But it is well to remember that these steels have different physical characteristics which must be thoroughly understood if Stainless is to give optimum results both in fabrication and in on-the-job performance. For that reason, expert advice on the selection and on the fabricating methods employed is vitally important. This we are prepared to furnish.

Our Stainless engineers are specialists in the use of Stainless Steel. Ask for their co-operation. You'll find their suggestions practical and extremely helpful not only in determining what grade of U·S·S Stainless will do the best job for you, but in showing how it can be handled most efficiently through the fabricating shop.



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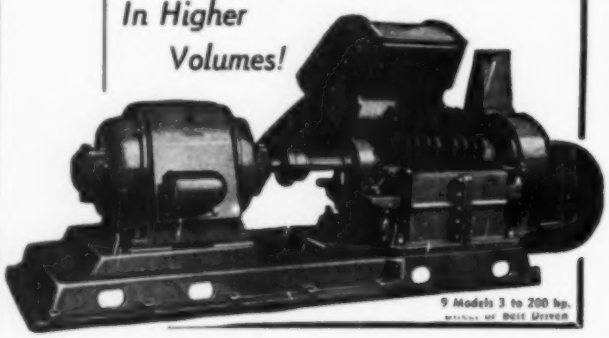
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Jay Bee Hammermills are centrifugal in type with multiple cutting hammers that travel at speeds in excess of 20,000 ft. per minute. Material fed into the mill is suspended over the hammers until it has been shattered to size. Finished particle size range from minus 1/64" to 1½". For additional information, write to J. B. Sedberry, Inc., Franklin, Tennessee, for folder CE-349

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High Pressure, Oil Filled, Pipe Type Cable Installation in New Orleans," S. E. Trouard, New Orleans Public Service.

"Engineering Aspects of Cathodic Protection as Applied to Pipe Lines," E. P. Doremus, O. L. Doremus and M. E. Parker, Cathodic Protection Service.

"Cathodic Protection Distribution in Some Zinc-Steel Systems," T. P. May, International Nickel Co., and George S. Gordon, Northwestern University.

"The Corrosion Products on Zinc Anodes Used Underground," E. A. Anderson, New Jersey Zinc Co.

**Pulp and Paper Industry. April 13.**

"Major Corrosion Problems in the Pulp and Paper Industry," Roy Whitney, Institute of Paper Chemistry.

"Round Table Discussion," led by H. O. Teeple, International Nickel Co.

"Corrosion of Digesters and Related Equipment," (Author unannounced), A. O. Smith Co.

"Non-Metallic Materials and Relation to Pulp and Paper Mill Corrosion Problems", Carl Richter, Stebbins Engineering and Manufacturing Co.

**General Industry. April 13.**

"Field and Laboratory Evaluation of Petroleum-Base Rust-Preventives," E. L. Walters and R. G. Larsen, Shell Development Co.

"Erosion-Corrosion of Metals and Alloys," W. A. Luce and M. G. Fontana, Ohio State University.

"Potencial Relationship between Zinc and Iron in Various Natural Waters," R. B. Hoxeng, Case Institute of Technology.

"Corrosion Characteristics of Titanium," P. H. Permar, Du Pont, and G. E. Hutchinson, Remington Arms Co.

**Transportation Industry. April 13.**

"Corrosion Aspects of Fusion Welding Aircraft High Strength Aluminum Alloys," L. W. Smith, Cornell Aeronautical Laboratory, Inc.

"Application of Corrosion Resisting Materials to Railway Electrical Construction," H. F. Brown, New Haven Railroad.

"Electrolytic Corrosion of Steel in Concrete," G. M. Magee, Association of American Railroads.

"Some Factors Influencing Corrosion in the Automobile Body," W. R. Wiers, Fisher Body Div. of General Motors Corp.

**Protective Coatings. April 14.**

"Porcelain Enamel as a Corrosion Resistant Coating," G. H. McIntyre, Perro Enamel Corp.

"Shop Coat Primers for Steel," S. C. Frye, Bethlehem Steel Co.

"Writing Specifications for Organic Metal Protective Coatings," W. W. Cranmer, Philadelphia Naval Shipyard.

"Cationic Chemical Pretreatment of Metal Surfaces," Wm. T. Deacon, Solvents and Plastics Co.

**Oil Industry. April 14.**

"Corrosion in Petroleum Processes Employing Aluminum Chloride," R. S. Treseder, Shell Development Co.

(Title unannounced), E. Q. Camp, Humble Oil and Refining Co.

"Anti-Corrosive Lubricants for Internal Combustion Engines," A. B. Culbertson, Shell Oil Co.

"Correlation Between Corrosion Survey Results and Actual Conditions," I. B. Tietze, Phillips Petroleum Co.

**Salt Water Corrosion. April 14.**

"Corrosion Resistance of Aluminum and Aluminum Alloys in Sea Water," William C. Stewart, U. S. Naval Engineering Experiment Station.

"Corrosion of Steel Pipe by Chlorinated Sea Water at Various Velocities," U. R. Volkening, Dow Chemical Co.

"Corrosion of Steel Piling in Sea Water," H. A. Humble, Dow Chemical Co.

"Deterioration of Steel Piling at Palm Beach," Beach Erosion Board.

**Gas Industry. April 14.**

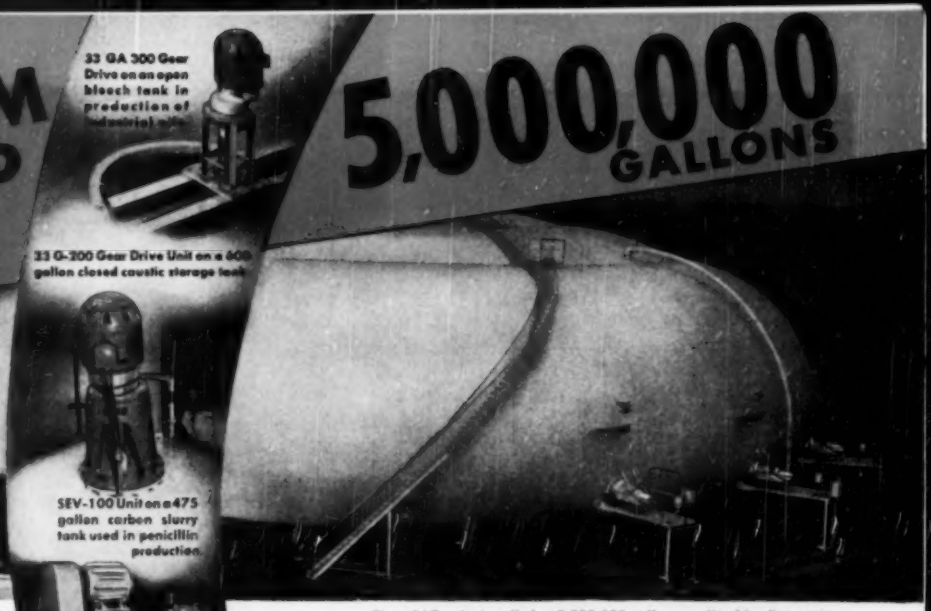
"Cathodic Protection of Gas Distribution Systems," A. W. Peabody and C. L. Woody, Ebasco Services Inc.

"Preparation of Reconditioned Pipe Surfaces for Effective Application of Bituminous Coatings," O. C. Mudd, Shell Pipe Line Corp.

"The Use of the Thermo Generator for Cathodic Protection," H. J. Findley, Eaton Manufacturing Co.

"Field Tests of Sodium Chromates and Alkalies for Controlling Corrosion in Gas-Condensate Wells," C. Kenneth Eilerts, Bureau of Mines.

# FROM 5 to 5,000,000 GALLONS



33 GA 300 Gear Drive on an open bleach tank in production of industrial salts.

33 G-200 Gear Drive Unit on a 600 gallon closed caustic storage tank.

SEV-100 Unit on a 475 gallon carbon slurry tank used in penicillin production.

Lightnin Portable Direct Drive used for blending small quantities of light liquids.

Three SAG units installed on 5,000,000 gallon gasoline blending tank.

AND ALL QUANTITIES IN BETWEEN

Mixco H-WC-200 Unit on a 1200 gallon starch slurry tank.

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When your process involves the agitation of liquids, regardless of tank size, a Lightnin or Mixco Agitator will do the job at the lowest possible initial and operating costs. And every mixer is specifically adapted and recommended for each individual job.

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**LIGHTNIN & MIXCO MIXERS ARE NOW USED FOR...**

- Mixing
- Dissolving
- Suspending Solids
- Emulsifying
- Heat Exchange
- Improvement
- Washing
- Reacting and Precipitating
- Extracting
- Liquid Gas Contacting
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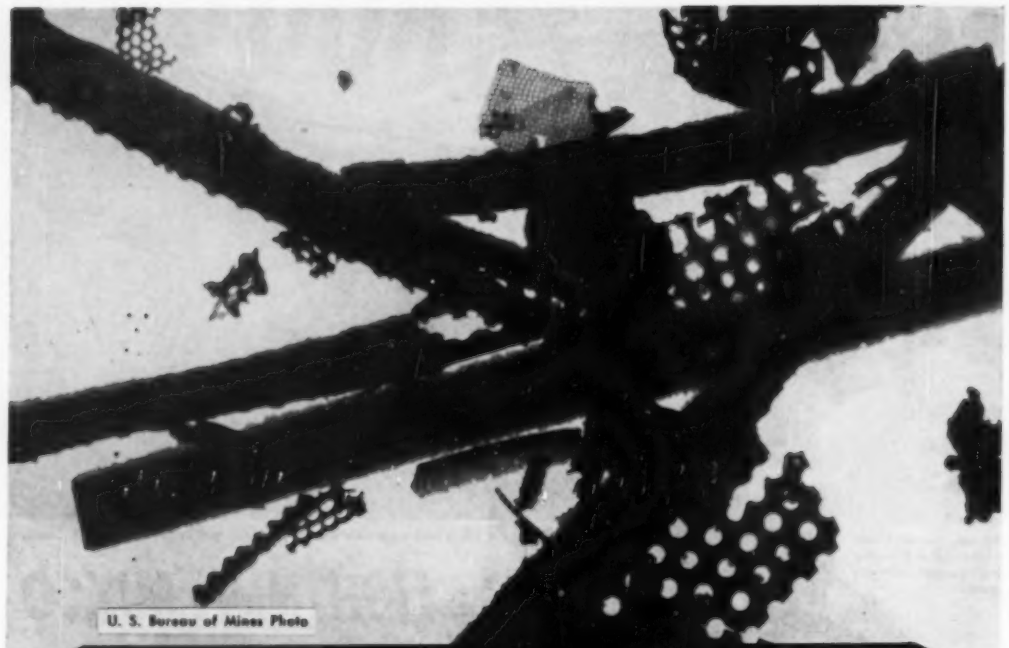
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Please send me the literature checked:

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- ☐ B-78 Top Entering Mixers
- ☐ B-75 Portable Mixers (Electric and Air Driven)
- ☐ B-77 Laboratory Mixers
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# The microscope shows why DICALITE® filteraids give brilliantly clear liquids

The photo reproduced above shows particles of Dicalite Speedflow magnified 6,000 times by the electron microscope. It illustrates more graphically than many words the reason Dicalite filteraids give brilliant clarity at high flowrates. The "needle-like", elongated, or otherwise irregularly-shaped particles assume a "straw-pile" arrangement in the filter cake. Millions of microscopically fine interstices are formed which trap the smallest solids, yet allow liquor flow at high rates. Besides Dicalite Speedflow there are other grades affording a wide range of performance so that you can regulate the operation of your filter station to meet production demands, or maintain desired clarity and output with liquors of varying filterability. Complete data gladly sent on request.

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# NAMES IN THE NEWS



## Man of the Month

**M. E. Dice**

This month (March 6-9) the American Institute of Chemical Engineers held its regional meeting in Los Angeles. General chairman of the successful meeting was Marion E. Dice—manager of General Petroleum Corp.'s economic department.

Chairman Dice has been with General since 1923—rising through drafting, testing, research, design, manufacturing and assistant to the president—to his present position in a department which is relatively new in corporation practice. His economics department serves as technical guide to top management.

Marion E. Dice was born not quite 50 years ago; spent his boyhood in Colorado; got his B.S. in chemical engineering from the University of Colorado; in 1926 received the first professional degree of chemical engineer conferred by that university.

He has made many contributions to petroleum engineering including the "Dice equation," the "Dice formula," volume-temperature measurement tables. Now his work has shifted more to economic problems of an integrated producing, manufacturing and marketing organization.

He is active in many organizations: ACS, AAAS, API, AIChE, American Economic Association, Western Oil and Gas Association, Sigma XI and Apha Chi Sigma. He is married, has two daughters, lives at 139 Ridge Road, Whittier, Calif.

**Harry F. Miller** has been appointed engineer of the Pittsfield works laboratory, General Electric transformer and allied products division. Dr. Miller succeeds **A. McK. Gifford** who has retired after 45 years of service.

**M. E. Gilwood**, formerly assistant manager of research, has been named manager of chemical research of the Permutit Co., New York.



M. E. Gilwood



H. A. Poitras

**Herman A. Poitras**, former superintendent of the Terre Haute, Ind., plant of Chas. Pfizer & Co. has been promoted to general production manager and **D. C. McClain** has been appointed director of engineering of all of the company's plants. At the main plant at Brooklyn, N. Y., **H. L. Denzler** was appointed superintendent. **A. J. Greene** and **E. H. Eppig** were promoted to assistant superintendents. **W. R. Townsend** was named as head of the engineering department.

**A. Paul Thompson** has been appointed director of research for the Eagle-Picher Co. Dr. Thompson fills the position left vacant some time ago by the death of **Earle W. McMullen.**

**Frederick M. Murdock** of Springfield, Mass., has been transferred to the patent department in St. Louis in charge of the patent work of the organic chemicals division of Monsanto Chemical Co.

**Anthony A. Williams** has been named assistant director of the product development department of the chemical division of Celanese Corp. of America. Mr. Williams is director of market research in the chemical division and will continue as head of market research and analysis as well.



J. F. Thompson



P. D. Merica

**John F. Thompson**, executive vice president of the International Nickel Co. of Canada, Ltd., since 1936 and a director and member of the executive committee since 1931, has been named president succeeding **Robert C. Stanley** who continues as chairman of the board. **Paul D. Merica**, vice president since 1936, and a director, is now executive vice president.

**Lee H. Bristol**, executive vice president of Bristol-Myers Co., New York, has been elected president of that company. He succeeds **Henry P. Bristol**, who became chairman of the board. **Delmas K. Kitchen**, director of the medical division was made a vice president and **Franklin H. Bivins** and **Gustave A. Jaeger** became assistant vice presidents.

**Edwin W. Tillotson**, assistant director of Mellon Institute, has been selected as the recipient of the Bleininger Memorial Award of 1949. This award is for "distinguished achievement in the field of ceramics." Presentation was made in Pittsburgh March 11.

**Athelstan F. Spilhaus** has been appointed dean of the institute of technology at the University of Minnesota.

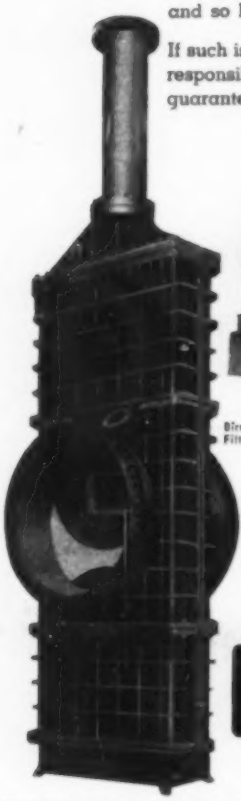
**Eugene G. Rochow** of Harvard University has been chosen to receive the third Leo Hendrik Baekeland Award of the American Chemical Society's North Jersey Section. The

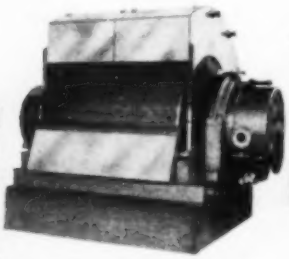
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66 years experience in building standardized and special process equipment of the highest quality . . . complete facilities for foundry, fabricating and machine work . . . these are our qualifications as the industry's outstanding designer and builder of those special design, special construction, or first-time pieces so often needed and so hard to obtain.

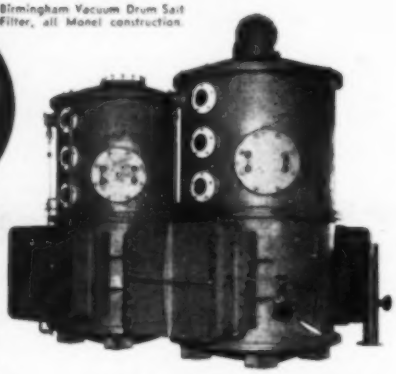
If such is your problem today, place it where sole responsibility for design and manufacture is your guarantee of satisfaction. In other words . . .





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72" Ring Follower Gate built for a large hydro-electric and reclamation project.

Cast Iron Horizontal Submerged Tube Evaporator designed and built to customer's specific requirements.

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award, established by the Bakelite Corp. and consisting of a gold medal and $1,000 in cash, is given biennially. Presentation of the award will be made at a meeting of the section on May 9.

**R. S. Wobus** has been appointed assistant plant manager of Monsanto Chemical Co.'s plant at Monsanto, Ill.

**George Martin** and **Allen P. Wherry** have joined the Pemco Corp. service department.

**Duffer B. Crawford, Erwin R. Strong, Jr.,** and **Judson S. Swearingen** have joined the technical staff of Southwest Research Institute, San Antonio, Tex.

**R. A. Emmett** has been promoted to assistant technical director in charge of rubber service, Binney & Smith Co. His headquarters will be in New York.

**Alfred T. Clifford,** senior chemist with the Interchemical Corp., textile colors division, Fair Lawn, N. J., since 1943, has joined the staff of Riegal Development Laboratories, Inc., at Ware Shoals, S. C.

**Wesley A. Armstrong,** factory manager of the wire division, United States Rubber Co., Bristol, R. I., has been appointed production manager for the mechanical goods, general products, lastex yarn and rubber thread divisions of the company with headquarters in New York. He has been succeeded at Bristol by **Frederick S. Bartlett.**

**Paul Sartoretto** and **Arthur Schwerdle** have become affiliated with the W. A. Cleary Corp. of New Brunswick, N. J.

**Roland S. Shumard** has been appointed coordinator of Monsanto Chemical Co.'s disinfectant and industrial preservative development for its organic chemicals division.

**Ralph M. Palmer,** president of the Ferro-Nil Corp., New York, is chairman of chemicals division, 1949 Salvation Army Appeal. Mr. Palmer has served eight years in this capacity.

**Carl Deuber** has been appointed assistant director of Centro Research Laboratories, Inc., Briarcliff Manor, N. Y.

**Arthur B. Lamb** of Harvard University, for the past 30 years editor of the *Journal of the American Chem-*

# "Was my face red!"





*"About ten years ago we tried centrifuging in our processing plant. For some reason, we got poor results and I promptly vetoed it and turned to something else."*



*"Recently, my new chief engineer suggested that centrifuging would speed our processing up. Looking very superior, I said, 'It won't work, Sam . . . forget it!' "*



*"But Sam was stubborn . . . he made a test installation and got far better results than anything we'd ever tried before! Naturally we switched to centrifuging on a full scale."*




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Write here any other process.....

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# SPARKLER
## *horizontal plate*
# FILTERS

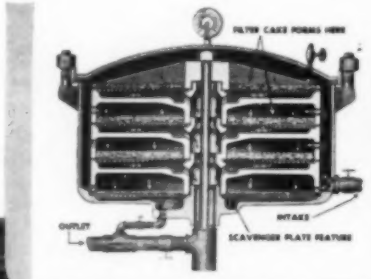
**—preferred by many in chemical processing plants because of two outstanding features — uniform microscopic filtration — complete recovery of product.**

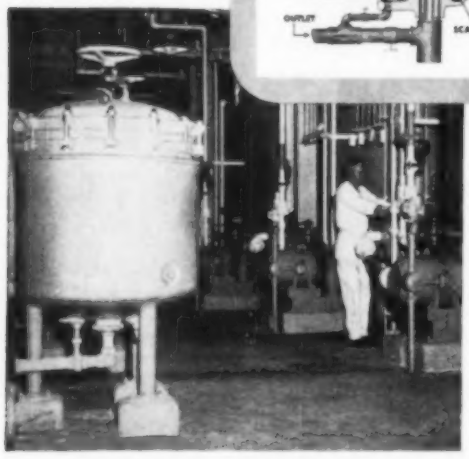
Unlike the construction of some other types of filters the horizontal plates in the Sparkler allow the filter media to form in an even cake of uniform thickness, built up in a horizontal position without stress and therefore not subject to cracking or slipping under pressure, thus assuring uniform filtration either with intermittent or continuous flow.

Complete recovery of product is obtained by "wash through" or "blow down" of cake without removal from filter. The Sparkler scavenger plate, with independent control valve, acts as an auxiliary filter, filtering each batch down to the "last drop" leaving no holdover.

Plates are available in two thicknesses, deep plates for liquids carrying a large proportion of solids and shallow plates for polishing operations. When shallow plates can be used the filter area is increased within the same size tank.

This illustration shows a Sparkler filter installed in the plant of a large producer of insulating varnish. Standard models are available in capacities of 60 to 7,500 G.P.H.



We invite correspondence on your filtering problem. The service of our engineers with over twenty-five years of experience in specific fields is available.

**SPARKLER MANUFACTURING COMPANY**
**Mundelein, Illinois**


*ical Society* will retire from that post at the end of 1949. Dr. Lamb's successor will be **W. Albert Noyes, Jr.**, of the University of Rochester.

**Floyd A. Eberly** has been appointed assistant director of production of the Upjohn Co., Kalamazoo.

**Elvin H. Killheffer** of E. I. du Pont de Nemours & Co.'s development department and **Charles A. Lynn**, veteran sales representative for Du Pont railroad finishes, have retired.

**Edward A. O'Neal, Jr.**, of Monsanto Chemicals Ltd., London, has been elected to the position of chairman of the British subsidiary of Monsanto Chemical Co. In addition, Mr. O'Neal will continue in his present position as managing director. He succeeds **Lloyd F. Nickell** who has resigned as chairman. Dr. Nickell plans to return to this country.

**John M. Hay** has been appointed to the research staff of Battelle Institute, Columbus, Ohio. Prior to joining the Battelle staff, he was associated with the Procter & Gamble Co.

**Raymond B. Seymour** is now executive vice president and general manager of Atlas Mineral Products Co.



R. B. Seymour



H. B. Hass

**Henry B. Hass**, head of the chemistry department at Purdue University, has been appointed manager of research and development of General Aniline & Film Corp.

**Joseph R. Mares** of Texas City, general manager of Monsanto Chemical Co.'s Texas division, has been elected a vice president of the company.

**Donald F. Ormerod**, formerly a chemist with the U. S. Bureau of Mines Oil-Shale Demonstration Plant, Rifle, Colo., has transferred to the anti-persistents branch, protective division, technical command, Army Chemical Center, Md. Other new personnel with the protective division include **Henry B. Lange**, chem-

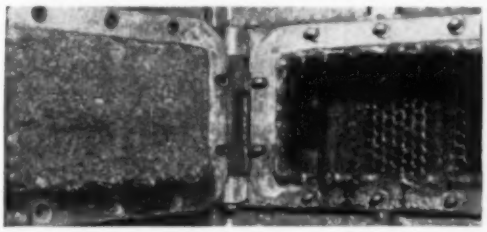
# Reducing Scale and Slime

## *For Better Heat Transfer and Longer Tube Life*

In petroleum refineries, petro-chemical and chemical plants the heat transfer rate of condensers and heat exchangers frequently is seriously reduced by the accumulation of foreign matter in the tubes. Seaboard plants may have slime, marine organisms and corrosion scale. Plants using inland waters are troubled by slime as well as various types of corrosion and mineral scales.

**Slime and Marine Organisms.** Algae, bacteria and foreign matter may accumulate on tube walls in the form of a tenacious slime or deposit. This condition varies with water temperature, suspended matter and with the nature of pollution from sewage and industrial wastes. Slime reduces heat transfer and, in seaboard plants, makes it easier for marine organisms to attach themselves to the tube walls.

Despite the use of screens, tiny organisms find their way into heat exchanger tubing, grow at a surprising rate and may soon impede water circulation. Marine organisms attached to water boxes or piping may be knocked loose and plug the tubes.



Marine growth on condenser water box and tube sheet in Gulf Coast installation

In estuaries where the salinity of water varies widely with the seasons, mussels and barnacles may be killed during periods of fresh water and their shells drawn into the tubes.

Deposits of solid substances, such as shells, may lead to corrosion pitting, and also may deflect cooling water against the tube wall, causing impingement corrosion.

**Corrosion Scale.** Some protective corrosion product or mineral deposit is desirable on heat exchanger and condenser tubing, but excessive scale reduces heat transfer. Waters containing critical amounts of calcium carbonate may deposit a thick calcium carbonate scale on tubing. In some Western and Southwestern areas heavy silicate and calcium sulphate scales are formed, which are difficult to remove.

Copper in clean sea water develops a layer-type scale of copper salts and cuprous oxide. Harbor water containing minute traces of hydrogen sulphide leads to a marked increase in scale thickness. Sea water at moderately high temperatures may form a thick calcium-magnesium carbonate scale on copper evaporator tubes.

**Cleaning Methods.** The choice of cleaning method depends upon local conditions. Some heat exchangers are dried out, and the peeling algae-type films are blown or washed out of the tubes. In many cases rubber plugs are forced through the tubes by high pressure streams of water. Some scales are knocked loose by steam jets. Where heavy scales are troublesome, particularly in evaporators, the tubing may be installed in a bowed position. As the temperature of the metal rises and falls, the tubes bend back and forth, flaking off the scale.

Chemical cleaning methods include the use of solutions of chlorine, chloramine or hypochlorite, but excessive exposure and injury to protective films should be avoided. Inhibited acids are used, which are designed to attack the mineral scale but not the tubes.

**Effect of Alloy Composition.** Copper and its alloys are much more resistant to slime and marine growths than are aluminum, steel and concrete because copper salts retard marine growths. The more corrosion-resisting alloys, such as Cupro Nickel, Duronze IV* (Arsenical Aluminum Bronze), and Aluminum Brass, which dissolve the least, are more susceptible to biofouling than Admiralty and Copper.

**Consult Laboratory.** Contact the nearest Bridgeport office for laboratory service regarding problems of longer tube life, improved heat transfer and reduced maintenance. Bridgeport manufactures a wide range of corrosion-resisting tube alloys, as well as Duplex Tubing of Copper or a copper-base alloy on one side and steel, stainless, aluminum, Monel or nickel on the other. Write for 120-page Condenser Tube Manual.

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Balanced infrared beams, reflected thru cells containing known and unknown gases, impart to sensitive bolometers the energy which has not been absorbed by the gases. The consequent resistance changes, automatically recorded, afford rapid, accurate, continuous determination of low concentrations for the particular gaseous component which is to be measured or controlled.

The Baird Associates infrared-absorption type gas analyzer provides precise determination of $CO_2$, CO, $CH_4$, $C_2H_2$, $C_2H_4$, $C_2H_6$, $C_3$'s, $C_4$'s, acetone, alcohol or similar vapors, and many more. Write for bulletin XXXI which gives detailed information. Our engineers are prepared to discuss specific applications.

*Baird Associates, Inc.*

INDUSTRIAL PHYSICISTS

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ical engineer with canister branch, and **Lawrence M. Hartman**, chemist, with anti-persistents branch.

**J. F. McGarry** is now assistant superintendent of Shell Chemical's new synthetic chemicals plant at Houston.

**William W. Eckenfelder, Jr.**, has been appointed as research assistant in the sanitary engineering department, New York University.

**Henry S. Moore** has been appointed director of engineering and development for the Consolidated-Ashcroft-Hancock divisions of Manning, Maxwell & Moore, Inc.

**H. W. Fisher**, a director and general manager of east coast refineries of Esso Standard Oil Co., has been appointed deputy coordinator of refining activities for Standard Oil Co. (N. J.).

**J. R. Carringer**, vice president has been appointed assistant to the president of Esso Standard Oil Co. in a series of organization changes. **H. G. Burks, Jr.**, has been elected a vice president and will succeed Mr. Carringer as contact director for the manufacturing, supply and transportation and chemical products departments. **M. W. Boyer**, vice president and director in charge of Louisiana manufacturing operations, will assume Dr. Burk's former position as director of all manufacturing operations for the company.

**A. A. Teeter** has retired as vice president of Chas. Pfizer & Co., Inc.

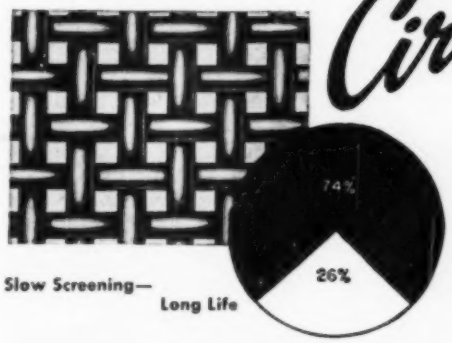
**Fred W. Cox, Jr.**, has been appointed assistant director of the Georgia Tech Engineering Experiment Station. He returns to Georgia Tech after serving as head of the applied chemistry division of the Southern Research Institute at Birmingham. Dr. Cox succeeds **Paul Webber** who has served as assistant director of the Station since 1941.

**W. J. Haring** has been appointed technical director of the Quaker Chemical Products Corp. of Conshohocken, Pa.

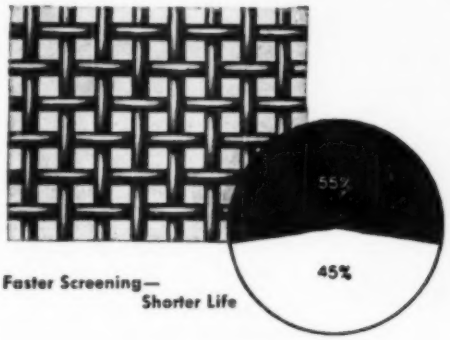
**John H. Schneider**, formerly senior patent attorney for the organic chemicals division of Monsanto Chemical Co. in St. Louis, Mo., has joined the Behr-Manning Corp., Troy, N. Y.

**Charles C. Price**, head of the department of chemistry at the University of Notre Dame, has been named the

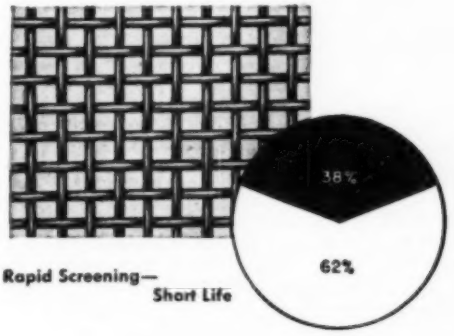
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Long Life




Faster Screening—
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Rapid Screening—
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Obviously no one type of wire cloth will fill every industrial requirement. The solution to any wire cloth problem lies in a full analysis of the conditions under which the screen is to be used and the manufacture of a screen that meets the specific need.

If you have a problem involving wire cloth we can probably answer it, for during the past 89 years Wissco and Calwico Wire Cloth have been meeting the needs of over 100 industries.

Our service covers the precision fabrication of wire cloth in a dozen different weaves. And whether you use wire cloth for screening, filtering, grading, cleaning or processing, you'll find Wissco and Calwico Wire Cloth will give long, dependable service. Made in all commonly used metals, these famous brands are designed to withstand chemical action, corrosion, abrasion, moisture or high temperature.

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*Super-Tempered* PRECISION SCREENS

Even under excessive vibration these screens won't wear loose in service. They're made of tough, super-tempered steel and woven on powerful hydraulic looms. Wissco and Calwico Super-Tempered Precision Screens stay tight and accurate throughout a long life. Any length required for vibrating screen or trommel can be furnished with welded, hooked, or reinforced edge to fit any type of vibrator. Write for details.

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(Above) Typical small-size R-C Meter with inclined differential gauge, with top inlet, and outlet in bedplate.

(Right) Example of large-size, low-pressure R-C Meter, side inlet box and bottom outlet, with a P.V.T.T. Recorder.

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outstanding young man in the state of Indiana for 1948 by the Indiana Junior Chamber of Commerce.

**John E. Garizio** has joined the technical service and sales division of the Reheis Co., Berkeley Heights, N. J.

**William A. Harvey,** University of California plant physiologist, has joined the development department of Monsanto Chemical Co.'s organic chemicals division, St. Louis.

**J. H. Babcock,** formerly manager of development and research, Hooker Electrochemical Co., has been named director in full charge of activities of that department.



J. H. Babcock



W. T. Nichols

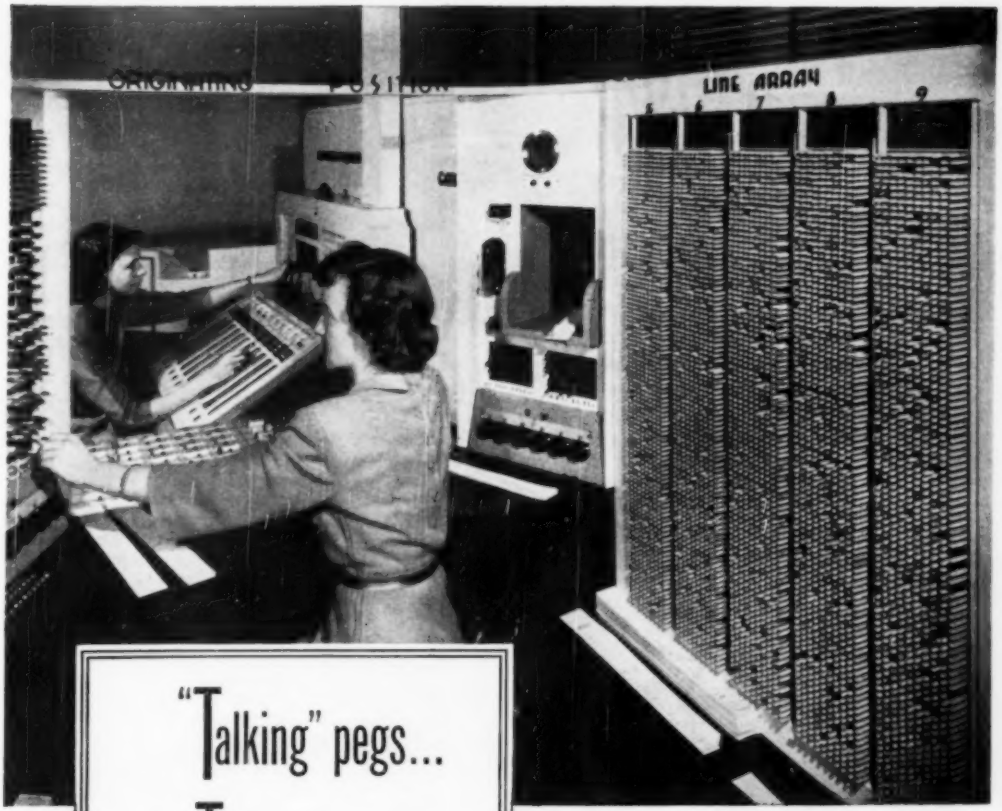
**William T. Nichols** has become director of the general engineering department of Monsanto Chemical Co. in St. Louis. Mr. Nichols, who was technical assistant to the executive vice president of Westvaco Chemical Co. joined Monsanto March 1.

**R. D. Perry** has been appointed to the new post of administrative assistant to the vice president and general manager, Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, B. C. **D. D. Morris** has been made general superintendent of the research and development division. **R. S. Woodford** is now general superintendent of the Alberta nitrogen department at Calgary.

**George M. Yesse, Jr.,** has joined Weyerhaeuser Timber Co. as chief of the process engineering section of the development department, Longview, Wash. Yesse comes from the engineering department of E. I. du Pont de Nemours & Co., Wilmington.

**Marshall T. Ramstad,** head of the industrial bureau of the Tacoma Chamber of Commerce, has been elected chairman of the Washington-Oregon section of the American Institute of Chemical Engineers.

**Sam L. Brous** has been appointed marketing manager of the General Electric Co.'s chemical department in




# "Talking" pegs... and Talking people

THERE ARE 10,000 pegs in this machine, representing 10,000 subscribers in a crossbar telephone exchange—the latest switching system which handles dial calls with split-second swiftness.

The pegs represent many types of telephone users—two-minute talkers and ten-minute talkers . . . people who dial accurately . . . those who make a false start or two. They are starting a journey through a unique machine which analyzes the performance of dial equipment in a typical central office.

But while an actual crossbar exchange connects your call in a matter of seconds, this counterpart moves far more slowly. It gives the Bell Laboratories engineers who built it time to observe what happens to each call—where bottlenecks develop, which parts are overworked or underworked, which of the circuits are most used.

In a manual exchange, the number of operators may be changed to meet different traffic conditions. In crossbar, all switching is done by complex electromechanical devices, permanently built in. This machine shows how many devices of each kind there must be in a new exchange to give you the best of service with a minimum of expensive equipment.

This traffic-study machine is one of the many ingenious research tools devised by the Laboratories as part of its continuing job—finding new ways to give you better and better telephone service.

**BELL TELEPHONE LABORATORIES**

EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

ANNOUNCING

NETTCO

AGITATOR DRIVES

NOW EXTRA-PROTECTED AGAINST LEAKAGE



**New Exclusive Design**

- **Positively stops leakage around shaft**
- **Protects product from contamination**
- **Prevents shaft scoring**

At no extra cost a new improvement in design has been added to Nettco Drives — the John Crane Rotating Seal. This precision shaft seal gives positive sealing over the full range of operating conditions. As with every feature of Nettco Agitators, this seal has been carefully engineered to simplify service and minimize maintenance. It's another reason why Nettco Agitator Drives are the first choice where dependability is a "must".

The new seal is standard equipment on Nettco Drives Models WT, T, TA, TB, and TAB. At low cost, any of these standard Nettco Models now in use can be made leak-proof with the new seal.

NEW ENGLAND TANK & TOWER COMPANY

87 TILESTON STREET, EVERETT 49, MASS.


Pittsfield, Mass. He is a former executive of the B. F. Goodrich Chemical Co. at Cleveland.

**Milton C. Hoffman** has been elected chairman of the Pennsylvania–New York western border section of the American Chemical Society. Mr. Hoffman, who is supervisor of chemical processing in the general engineering department, radio tube division, Sylvania Products, Inc., succeeds **Charles W. Cable** of the United Refining Co.

**Roy Vance** has been appointed as chief chemist at the Ohio Rubber Co.

**Raymond Seven** has been appointed research chemist at Edwal Laboratories, Inc., Chicago.

**James W. Raynolds**, former vice president and director of the Sun Chemical Co. of New York, has joined the General Electric Co.'s chemical department as sales manager of silicone products, with headquarters at Waterford, N. Y.

**Duff Smith**, for five years district manager for the Foster-Wheeler Corp. in Houston, has been moved to London to become sales promotion manager for the company in continental Europe. **Wilson J. Pais** is acting manager at Houston now.

**A. C. Atwater** has joined Thomas Bryan & Associates, industrial engineers at Houston, as manager of the petroleum and chemical division that has recently been organized. Atwater, a chemical engineering graduate of M.I.T., had been previously associated with Beech-Nut Packing Co., Atlantic Refining Co. and Arthur G. McKee & Co.

**D. R. Johnson** has been named manager of Continental Oil Co.'s manufacturing department, and will supervise the company's eight refineries. Johnson, formerly manager of the southern region of the manufacturing department, will be succeeded by **L. W. Vickery**, superintendent of Continental's refinery at Ponca City, Okla.

**Henry J. Perry**, New York, has opened a consulting service to the pulp and paper industry.

**A. E. Buchanan, Jr.**, manager, technical division, has been designated acting assistant manager, rayon department, E. I. du Pont de Nemours & Co., replacing **H. J. White** who has retired. **G. Preston Hoff** succeeds Buchanan as manager of



FROM ALKYD RESINS

TO DE-ICING PAINTS



*Nothing takes the place of Glycerine*

Ask the man in the plant. He knows that the chemical properties of glycerine help build tough, durable alkyds and resin gums. He knows that he can count on its uniformity and ease of handling.

Ask the research man. He finds that glycerine fortifies many modern corrosion-proof coatings . . . that its plasticizing action adds flexibility to today's masking finishes . . . that its anti-freeze qualities are ideal for aircraft de-icing paints.

Ask any leader of the coatings industry—or almost *any* industry. He'll agree that for a combination of physical and chemical properties that no other product can equal . . . for well-proved performance in more than 1500 fields of application in modern industry—*Nothing takes the place of glycerine!*

**GLYCERINE PRODUCERS' ASSOCIATION**

295 Madison Avenue
NEW YORK 17, NEW YORK


## *Technical* GLYCERINE NEWS

**NEW-TYPE RESIN.** Description: pale, semi-solid made by interaction of glycerine with rosin fraction of tall oil. Properties: tacky, stable, unaffected by humidity changes, has solubilizing action on many materials. Uses: has potential applications in protective coatings, soap, adhesives, and synthetic rubbers. (R-1)

* * *

**NEW METHOD DETERMINES GLYCERINE COLOR.** A faster, more accurate method has been developed in the research laboratories of the Glycerine Producers' Association. The method, which utilizes the spectro-photometer, corrects defects of the old visual Lovibond method. (R-2)

* * *

**APPROVED FIRE-RESISTANT DECORATIVE FINISH.** Alkyd resins form the base for a new finish for interior decoration approved recently by the Bureau of Standards of Appeals of New York City. The coating is formed by spraying specially prepared fibers onto a surface treated with a fire-resistant adhesive. (R-3)

* * *

**NEW CORK SUBSTITUTE.** Glycerine is employed as a plasticizer to produce flexibility in a new cork substitute patented recently. The compound is claimed to have bulk density and resilience comparable to natural cork. (R-4)

* * *

**ANTI-STICK COATING.** Major problem in the use of bitumen-coated steel sheets in building trades is the adhesion of the tacky sheets to each other in storage. Answer to the problem may be a new anti-stick coating in which glycerine is an essential ingredient. (R-5)

GLYCERINE PRODUCERS' ASSOCIATION, DEPT. 4
295 MADISON AVENUE
NEW YORK 17, N. Y.

I should like to receive more information on the source of the items appearing in Technical Glycerine News. I have checked below those items which interest me.

☐ R-1 ☐ R-2 ☐ R-3 ☐ R-4 ☐ R-5

NAME .....
COMPANY .....
ADDRESS .....

# high ratios ?




ONE OF 93

**DE LAVAL**
**DOUBLE REDUCTION WORM GEARS**

De Laval double reduction speed reducers, consisting of combinations of double worm gear reductions, or helical and worm gear reductions, are available with overall ratios up to approximately 8000 to 1. De Laval single reduction worm gear speed reducers are available in ratios up to 90 to 1. If high ratios are your requirement, worm gear speed reducers are the answer—particularly if space is limited and reliability is important. A De Laval representative will help you pick the right size and type.

This double reduction De Laval Worm Gear Speed Reducer is available in many standard ratio combinations, with horizontal or vertical output shafts and is but one of 93 sizes and types of standard De Laval Worm Gear Speed Reducers.

WG-14 **DE LAVAL**

*Worm Gear Division:* De Laval Steam Turbine Co., Trenton 2, N. J.

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS
CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS


the technical division and **Winfield W. Heckert,** formerly director of acetate rayon research, has been named assistant manager of the division, succeeding Dr. Hoff.

**Glenn L. Allen, Jr.,** of Dow Chemical Co., Pittsburg, Calif., is the new chairman of the northern California section of the American Institute of Chemical Engineers.

**Frank W. Volk,** assistant superintendent at Brunswick, Ga., for Hercules Powder Co., has been transferred to Hattiesburg, Miss. **Harry W. Watson,** assistant superintendent at Hattiesburg, has been transferred to the Brunswick plant. The move was made to further integrate the work of its two naval stores plants.

**David E. Eichelberger** has been appointed president of American-Marietta Co. and **Douglas E. Bryant** is manager of its subsidiary, Leon Finch Ltd., Los Angeles. Mr. Eichelberger succeeds **Leon Finch** who recently retired from the presidency because of illness.

**Edgar Reynolds Smith,** chief of the physical chemistry section of the National Bureau of Standards, has been awarded the 1949 Hillebrand Prize of the Washington section of the American Chemical Society. The prize was presented to Dr. Smith on March 10 at the annual dinner of the section.

## OBITUARIES

**Bernard T. Nolting,** 61, secretary of Welch, Holme & Clark Co., Inc., importers and dealers in oils and chemicals, died January 12.

**Jefferson Bartow Osborn, Sr.,** 87, who had been associated with the Rumford Chemical Co. for 44 years when he retired in 1930, died in Atlanta January 19.

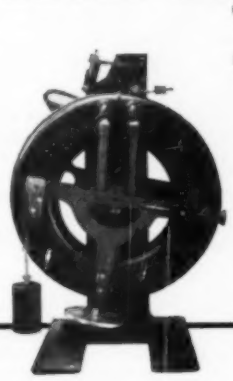
**Frank Cazenove Jones,** 61, president and general manager of the Okonite Co., Passaic, N. J., died in New York January 20.

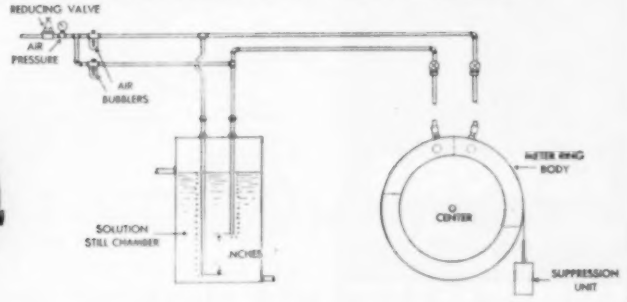
**Tenney L. Davis,** 59, professor emeritus of organic chemistry at Massachusetts Institute of Technology, died January 25.

**Harry Woodward Beedle,** 69, former manager of Boston branch, the Electric Storage Battery Co., died on February 3.

**Henry F. Atherton,** 65, chairman of the board of Allied Chemical & Dye Corp., died in Florida February 10.

# LIQUID SPECIFIC GRAVITY
## *is easily measured with*
# HAGAN RING BALANCE METERS






Almost any meter based on the differential pressure principle might be used to measure the specific gravity of liquids—but it can be done most easily and accurately with Hagan Ring Balance Specific Gravity Meters.

One simple method, utilizing a still tank, is shown in the diagram. Differential pressure in this arrangement is a function of the distance "H" and of the specific gravity of the liquid. The necessary pressure differential can be created in a number of other ways, the design of the meter, particularly its sensitivity to low differentials, giving the user wide latitude in this respect.

It is often desirable to make the full width of the meter chart available for recording only the range of specific gravities encountered in a specific application. With the Hagan Ring Balance Meter, this is accomplished by hanging a suppression weight on the ring body. No other meter affords so simple and accurate a method of suppression.

The same basic arrangement may be used to control specific gravity of any liquid, for control mechanisms are easily added to any Hagan Ring Balance Meter. Addition of a second ring which measures the liquid flow, can give the user a specific gravity compensated flow meter. Temperature or pressure compensation, or both, may be added.

A chart record of these quantities can be provided, together with compensated and uncompensated records of specific gravity.

**For full information on this and other applications of Hagan Ring Balance Flow Meters, just fill out and mail the coupon below. Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.**

HAGAN HALL BUROMIN CALGON

**HAGAN CORPORATION**

RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTORQ FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
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HAGAN CORPORATION
Ring Balance Meter Division
323 Fourth Avenue, Pittsburgh 30, Pa.

Please send full information on Hagan Ring Balance Flow Meters. I am particularly interested in the application described below.

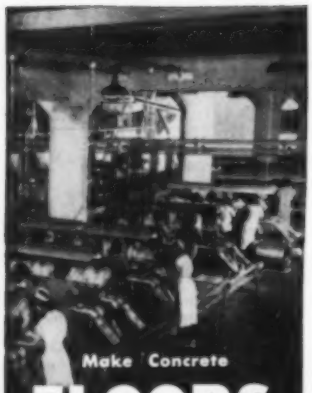
NAME

POSITION

COMPANY

STREET AND NUMBER

CITY AND STATE CE-3



Make Concrete

**FLOORS**

last longer . . . look better

*with*

**NUKEMITE 40**

**PROTECTIVE COATING**

● Offering wear resistance superior to standard oil based floor enamels, NUKEMITE 40 Protective Coating is also ideal where chemical action is a factor. It is produced in several colors, making it possible to give your plant floor a cleaner, more attractive appearance.

Nukemite 40 is a vinyl copolymer solution that bonds firmly and forms a tough coating when dry. It resists acids, alkalies and petroleum solvents—does not saponify when subjected to cleaning agents—gives long-lasting protection even under severe abrasive conditions. It is odorless, tasteless and non-contaminating; fully tested and proved in a wide range of practical applications.

**EASY TO APPLY**

Nukemite 40 is easily applied by brush or spray method after preparation of the floor by cleaning and rinsing. Minimum out-of-service time (36 hours) is required for application of primer, application of Nukemite 40, and drying — another NUKEMITE feature.

*Specify Application and Order a Trial Kit Today. $3.30 prepaid.*

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Nukem

**NUKEM**

**PRODUCTS CORPORATION**

98 Colgate Avenue

BUFFALO 20, N. Y.


# INDUSTRIAL NOTES

**Rockwell Mfg. Co.**, Pittsburgh, has named Floyd V. Snodgrass general manager of the Nordstrom valve division's Oakland, Calif., plant.

**Pennsylvania Salt Mfg. Co.** has opened a district sales office in Appleton, Wis., for its heavy chemicals division. C. H. Anderson is sales manager.

**B. F. Goodrich Co.**, Akron, has merged its industrial products sales division with its plastic products sales and production departments into the industrial and general products division. E. F. Tomlinson is division general manager.

**Pittsburgh Corning Corp.** is transferring its home offices to 307 Fourth Ave., Pittsburgh.

**Silon Inc.**, Wooster, Ohio, has been chartered to manufacture and deal in products yielding solids, pastes or solutions suitable for coating or impregnating compositions, cement and other materials.

**Goodyear Tire & Rubber Co.**, Akron, has created a vinyl film and fabrics sales department. It will be headed by James S. Bruskin. He will be assisted by E. J. Dunlavy and W. E. Channing.

**Swartwout Co.**, Cleveland, has established an office in Philadelphia for its power plant control equipment division.

**Binney & Smith Co.**, New York, has appointed George H. Brannan to manage pigment sales in the Philadelphia office.

**Food Machinery and Chemical Corp.** has opened a new district office in Omaha, Neb., for its Peerless Pump division. J. W. L. Stone has been appointed district manager.

**Tube Turns, Inc.**, Louisville, Ky., has appointed the Ardun Co. of Tulsa, Okla., as a distributor of welding fittings and flanges.

**Syntron Co.**, Homer City, Pa., has established new sales offices in Houston and Dallas with W. C. Leasure and Nelson C. DeVilling as their respective managers. Dick McHale has been made district sales manager of the Los Angeles office; James B. Barth


J&C **ZENITH**

**CONTINUOUS PULP PRESS**



WITH J&C'S NEWEST DEVELOPMENT "Floating Cone"

JACKSON & CHURCH COMPANY'S ZENITH CONTINUOUS PULP PRESS offers GREATER efficiency and GREATER profits . . . with the hydraulically operated cake discharge port or "floating cone."

Long the finest dewaterer on the market, Zenith's new 100% automatic operation assures CONSTANT, UNIFORM discharge pressure at any pre-determined degree. Finger-tip adjustment assures drier cake of uniform consistency.

These engineering triumphs . . . found only in Zenith Press . . . are available to paper pulp, cannery, corn starch, fish reduction, meat packing, glue, citrus waste drying and many other processes.

For further plant uses, for individual problems or for engineering or additional data, write Jackson & Church Company at Saginaw, Michigan.

A PRODUCT OF

**JACKSON & CHURCH COMPANY, SAGINAW, MICHIGAN**

"Work well done since '81"

*Chemicals you live by*



# Teach your products new tricks!

CHLOROWAX* 70, Diamond Alkali's chlorinated paraffin wax, can add a trick or two to many different products—tricks that solve live problems and open the door to wider sales.

For instance, consider paints intended for industrial exteriors or interiors. CHLOROWAX 70 will increase their resistance to chemical action, give them greater adhesion and can provide fire-retardant qualities. Or, as another example, CHLOROWAX use in textile coatings, when properly compounded, adds flame and moisture resistance, producing textiles which meet specifications set up by several government agencies for flame-proofing and water-proofing.

CHLOROWAX 70 is a powdered solid, definitely resinous, containing 70% chlorine. It is inert, non-toxic, non-inflammable, non-soluble in water, yet soluble in a wide variety of organic solvents. If you are interested in this versatile DIAMOND product, why not get in touch with your nearest DIAMOND Sales Office or write direct. Our Technical Service Staff is available to aid you in applying CHLOROWAX 70 to your products.

## SOME PROPERTIES OF CHLOROWAX 70:



### Resistance to moisture and chemicals

CHLOROWAX 70 increases resistance to moisture and to chemical action when used for textiles, paper coatings, paints and caulking compounds.



### Adhesion

CHLOROWAX 70 increases adhesive qualities of protective coatings when applied to most surfaces.



### Flame resistance

CHLOROWAX 70 builds in flame resistance when properly compounded in paints, paper coatings, glues, textiles and plastics or when impregnated in wood.



### Gloss

CHLOROWAX 70 is often used to improve gloss where desired in paper coatings, paints, printing inks and other finishes.

**DIAMOND SALES OFFICES: Boston, New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Wichita, Oklahoma City and Houston. Also representatives in other principal cities.**

## DIAMOND CHLOROWAX 70

DIAMOND ALKALI COMPANY . . . CLEVELAND 14, OHIO

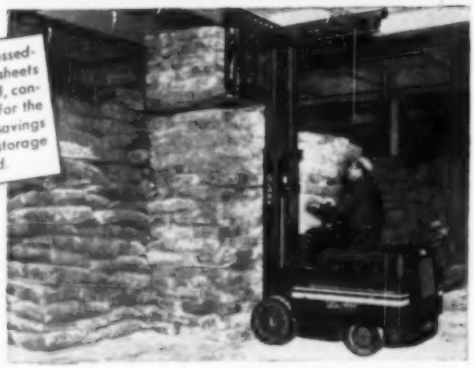
DIAMOND ALKALI CHEMICALS

*U. S. Reg. Pat. Off.

# MATERIAL HANDLING *News*



Paper drums of pharmaceuticals at roof-truss level are immediately accessible to this Clark Electric battery-powered Carloader. Increased storage capacity and faster handling make profitable good reading.



Bags of chemicals crossed-piled on load carrier-sheets of disposable material, constitute natural loads for the Clark Pul-Pac. Time savings are substantial—and storage capacity is multiplied.



WRITE FOR *Material Handling News* —"must" reading.

TACKLE THOSE HANDLING COSTS! It is one of the surest ways to protect and increase profits, say Industry's wisest counsellors; and one of the few remaining opportunities for appreciable savings. The Clark Method expands the capacity of any business by speeding up the flow of material. It increases storage capacity without plant expansion. It minimizes demurrage and costly accidents. It is good common-sense—and now is the time—to CONSULT CLARK.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS AND INDUSTRIAL TOWING TRACTORS



INDUSTRIAL TRUCK DIV., CLARK EQUIPMENT COMPANY BATTLE CREEK 8, MICH.
REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD
AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS


has been appointed to the Pittsburgh sales force while G. R. Stocum is being placed in Chicago. D. E. Nugent had been named to take over power tools sales in Kansas City, Mo.

**Binks Mfg. Co.**, Chicago, has elected Joseph D. Linehan to fill a vacancy on the board of directors.

**Standard Oil Co. (Indiana)**, Whiting, has announced the election of Howard R. Peterson as vice president of Indoil Chemical Co., a chemical subsidiary.

**Alloy Steel Products Co.**, Linden, N. J., has opened a New York sales office with Richard E. Boller, Jr., as district manager. Associated with Mr. Boller are R. O. Dale, H. G. Harley and Elliot A. Baines, sales representatives.

**Hardinge Co., Inc.**, York, Pa., held a national sales meeting from January 10-12, during which a 25 year club was formed.

**Mason-Neilan Regulator Co.**, Boston, now has on a nation-wide tour a new field demonstrator showing many of its new developments.

**E. F. Drew & Co., Inc.**, New York, has made George H. Kent director of sales. He will be responsible for the coordination of all sales activities of the operating divisions.

**Phoenix Oil Co.**, Augusta, Ga., has organized Phoenix Chemical Co. for the manufacture of detergents, adhesives, resins, dyestuffs and dispersing agents. Officers are W. L. McCrary, Jr., president; O. O. McGahee, vice president; Laurie E. Whittelsey, general manager; W. Paul Bolen, director of research.

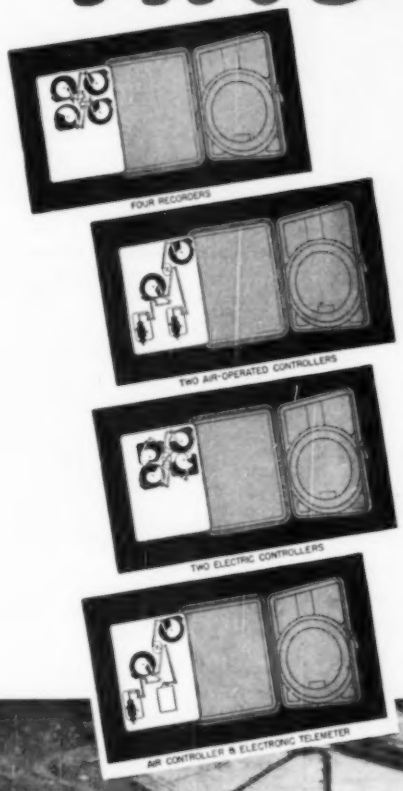
**Emulsol Corp.**, Chicago, has appointed the Hukill Chemical Co., Cleveland, to represent it in Ohio and western Pennsylvania.

**Spencer Chemical Co.**, Kansas City, Mo., has appointed Howard Millington chemical sales representative in the Chicago, Milwaukee, Minneapolis, St. Paul, Detroit, Cincinnati and Cleveland area. He will maintain offices in Chicago.

**Hardinge Co., Inc.**, York, Pa., has announced the appointment of R. C. Ferguson as north central district manager with headquarters in Hibbing, Minn.

**Walter Kidde & Co., Inc.**, Belleville, N. J., has made S. G. Freck manager of the industrial commodities department formerly headed by W. E.

# these and 100,000 more




## FROM 4 CIRCUITS AND 8 BASIC PARTS

What's your control problem? Flow—temperature—level? Are you using solids—liquids—gases?

No matter what you process, four basic circuits and eight basic component parts will give you more than 100,000 different electronic measuring and controlling combinations. That's how Bailey has simplified controls for processing industries.

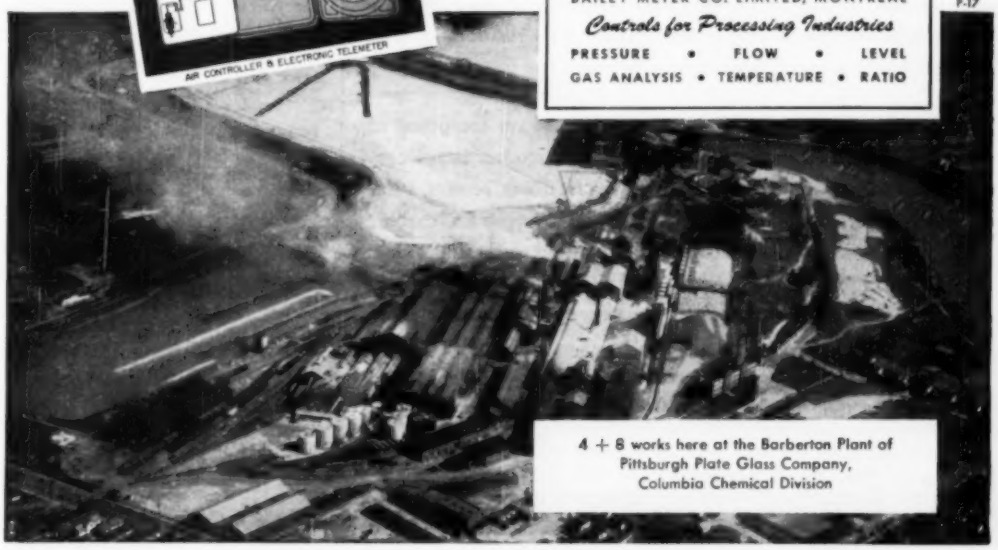
The four arrangements illustrated show how easily Bailey interchangeable parts can be used. It's no longer necessary to carry a huge stock of replacement parts for emergency control installations. When you standardize on Bailey controls you are always ready to meet changing conditions within your plant.

And with Bailey simplified controls, your maintenance costs will be less. Maintenance men quickly become familiar with Bailey controls and spend less time on maintenance and installation.

To see for yourself how you can profit with Bailey controls, write for a copy of our bulletin No. 17.

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**1054 Ivanhoe Road • Cleveland, Ohio**
BAILEY METER CO. LIMITED, MONTREAL
*Controls for Processing Industries*
PRESSURE • FLOW • LEVEL
GAS ANALYSIS • TEMPERATURE • RATIO

P-17



4 + 8 works here at the Barberton Plant of Pittsburgh Plate Glass Company, Columbia Chemical Division




## *This tank will live to a ripe old age* because it is PYROFLEX-Constructed

Pickling tanks lead a tough life. The Pyroflex-Constructed Pickling Tank above is in use in a continuous strip steel line in a large Ohio steel mill. It is subject to constant attack by acids, steam and other corrosive agents. To make this tank completely corrosion proof, Knight engineers specified Pyroflex sheet lining heat bonded to the steel shell, then covered with Knight-Ware Tile set in Permanite acid-proof cement. The result is a tank completely resistant to this highly corrosive type of service.

However, Pyroflex Construction is not always composed of these same materials. In designing various corrosion proof constructions such as tanks, chlorinating towers, floors, sewers, fume ducts, etc. Knight engineers may incorporate ceramics, carbon, glass, plastics or any other materials best suited to the individual situation. Consequently Pyroflex-Constructed units live to a ripe old age with less "down time" and lower maintenance costs.

When making inquiry regarding Pyroflex Constructions, please specify type of equipment in which interested, service conditions involved, etc.

**Maurice A. Knight** 103 Kelly Ave., Akron 6, Ohio
**Acid and Alkali-proof Chemical Equipment**

Morgan, Jr. Mr. Morgan assumes Mr. Freck's former position as head of industrial sales.

**Elgin Electronic Laboratories,** Elgin, Ill., has been formed by Robert K. Remer to handle engineering, chemical and production mechanization problems in the dyestuff, ink, dyeing and coloring fields.

**Plough, Inc.,** Atlanta, has purchased the Memphis, Tenn., plant of American Coating Mills, a subsidiary of Owens Illinois Glass Co.

**Houdry Process Corp.,** Philadelphia, has announced that Continental Oil Co. has officially accepted its new thermofor catalytic cracking unit at Denver, Colo.

**Minneapolis-Honeywell Regulator Co.,** Minneapolis, has made O. B. Wilson sales manager for the east, southeast and central regions.

**Monsanto Chemical Co.,** St. Louis, Mo., has appointed Kenneth W. Short purchasing agent for its plastics division at Springfield, Mass.

**Devoe & Raynolds,** New York, has elected A. W. Bornhauser president of its division, Jones-Dabney Co., Louisville, Ky.

**Willis Corp.,** Columbus, has been formed to manufacture automotive and industrial filtration equipment. President of the firm is W. Rockford Willis.

**Texas Gulf Sulphur Co.,** New York, has elected Herbert E. Treichler a vice president.

**Dodge & Olcott, Inc.,** has opened an office at 735 Spring St., N.W., Atlanta. Earl W. Kersten is in charge.

**Distilled Spirits Institute,** Washington, D. C., has re-elected R. E. Joyce as its president.

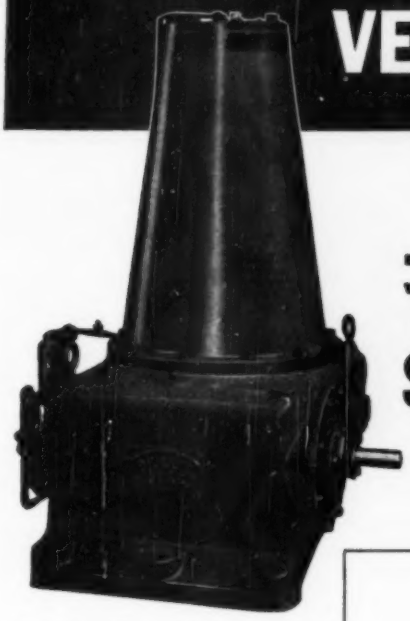
**Glidden Co.,** Cleveland, has appointed Charles M. Dunn, Jr., assistant manager of its direct sales department.

**Chain Belt Co.,** Milwaukee, has opened two new district sales offices in St. Louis, Mo., and Jacksonville, Fla. The offices are headed by Clarence R. Studer and David B. Hill, respectively.

**Continental Can Co.,** New York, has elected George P. Edmonds a member of its board of directors.

**Phelps Dodge Copper Products Corp.,** New York, has elected Wylie Brown

# For drives requiring long, unsupported VERTICAL SHAFTS

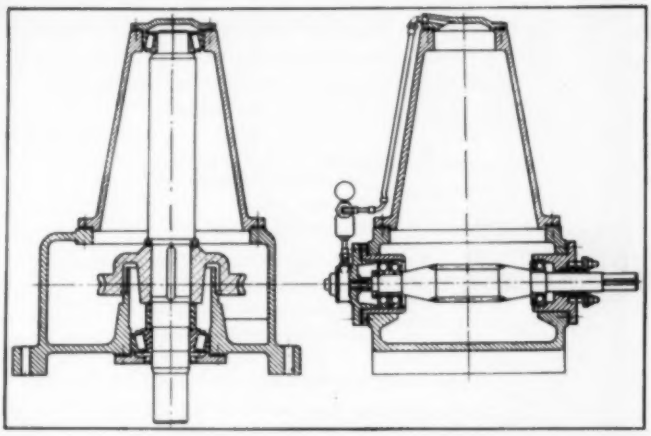


## . . . the new Philadelphia "Steeple" Type Worm Gear Speed Reducer fills a long-felt need.

The "Steeple" type Vertical Worm Gear Reducer was especially developed, and has had much successful use in the numerous Process Industries for driving: Agitators, Mixers, Circulators, Pumps, Washers,—or any other vertical type drive which calls for sturdy, reliable speed reduction.

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Write for full details on your business letterhead.



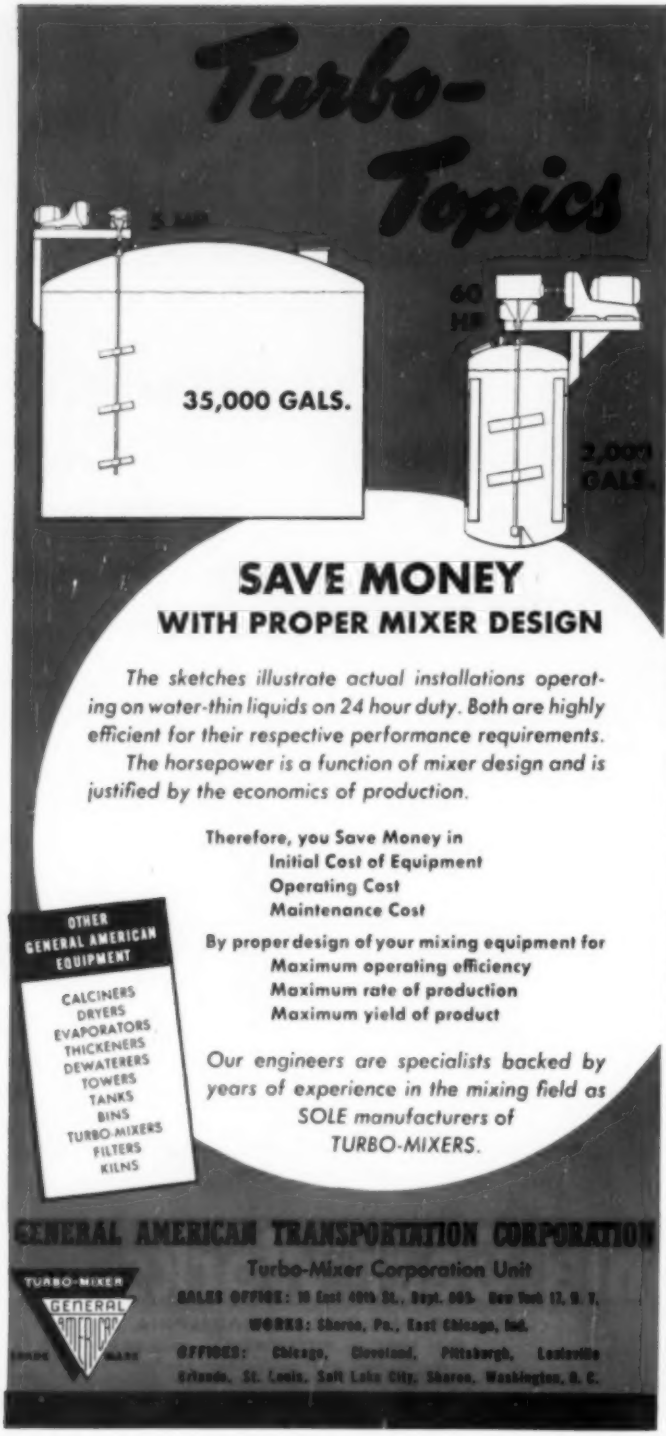
**The views above illustrate cross sections through the worm and worm gear shafts.**

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chairman of the board of directors. He will continue as chief executive officer of the corporation. Whipple Jacobs has joined the corporation as president.

**Goodyear Tire & Rubber Co.**, Akron, has appointed John Hussey and E. J. Hill as district sales managers in the New England and Cleveland areas, respectively.

**Hewitt-Robins Inc.**, New York, has appointed Bernard H. McGuiness vice president of its Robins Conveyors division.

**Goodyear Tire & Rubber Co.**, Akron, chemical division, has promoted Ralph T. Hickox to district manager in Los Angeles.

**Pollock Paper & Box Co.**, Dallas, Tex., has changed its name to Pollock Paper Corp.

**Johns-Manville Corp.**, New York, has made Maurice Davier general manager of the Van Cleef division.

**American Flexible Coupling Co.**, Erie, Pa., has appointed Ehret & Kinsey, Chicago, as sales engineers.

**Wheelco Instruments Co.**, Chicago, has opened a district office in Houston, Tex. It will be headed by George Hatfield.

**Kinney Manufacturing Co.**, Boston, Mass., has opened a branch office at Cleveland, Ohio. William B. Mills will be manager.

**Peninsular Rubber Co.**, Port Clinton, Ohio, has been formed to produce rubber products for the automotive and allied industries.

**Trundle Engineering Co.**, Cleveland, Ohio, has incorporated a subsidiary company called Trundle Associates, Inc.

**Locks Inc.**, Baltimore, Md., has named S. P. Brady Chicago regional manager.

**Vapor Recovery Systems Co.**, Compton, Calif., has moved its Tulsa branch office to 409 Tuloma Building.

**Attapulgus Clay Co.**, Philadelphia, has appointed Irdving A. Cole manager of its technical division.

**Monsanto Chemical Co.**, St. Louis, has transferred the manufacturing operations carried on at its Decatur, Ill., plant to other company locations.

**Freeport Sulphur Co.**, New York, has elected E. D. Wingfield a vice president. He will be in charge of southern

operations and will have offices in New Orleans.

**Commercial Solvents Corp.**, New York, has elected Austin S. Inglehart and Harold H. Helm to the board of directors.

**Manning, Maxwell & Moore, Inc.**, Bridgeport, Conn., has appointed Clifford E. Mathewson, John R. Parsons and A. C. Stauch as industrial instrument specialists.

**Link-Belt Co.**, Chicago, Ill., has made R. E. Whinrey assistant general manager of the Link-Belt Dodge plant in Indianapolis. L. C. Heinlein has been appointed superintendent of this plant.

**United States Steel Corp.**, New York, has established a separate stainless steel sales division. Banks E. Eudy and C. Richard Horwedel have been appointed manager and assistant manager, respectively, of the new division.

**International Paper Co.**, New York, has elected Richard C. Doane vice president in charge of sales.

**Burdett Oxygen Co.**, Cleveland, Ohio, has installed a new $150,000 oxygen producer. The new equipment is expected to increase capacity about 60 percent.

**Process Industries Engineers Inc.**, Pittsburgh, has been formed and will combine sales and engineering functions. Its officers are Wm. W. Calihan, R. R. Maccary, R. E. Nelson and R. F. Fey.

**DeBell & Richardson, Inc.**, has moved its offices and laboratories to its own building in Hazardville, Conn.

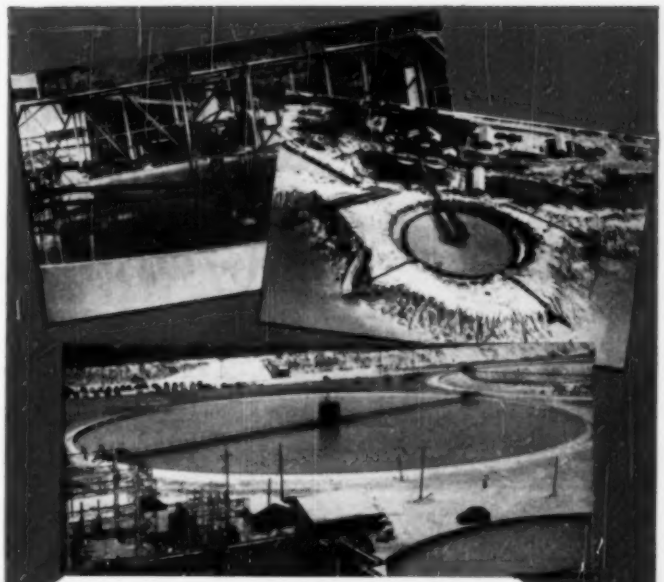
**Wittichen Chemical Co.**, Montgomery, Ala., has doubled the capacity of its chlorine filtering plant.

**Allegheny Ludlum Steel Corp.**, Pittsburgh, Pa., has made Robert M. Arnold a vice president.

**Monsanto Chemical Co.**, Everett, Mass., has opened a district office in Charlotte, N. C., for its textile chemical department.

**Emulsol Corp.**, Chicago, Ill., has appointed Pesticide Advisory Service, New York, as its technical sales representative in the agricultural, sanitation and industrial chemical manufacturing industries in the state of New York and upper New Jersey.

**Syntron Co.**, Homer City, Pa., has made Mark Chisholm district sales manager of a newly established sales

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office in Des Moines, Iowa. Ernest K. Hood is the district sales manager of a new sales office in Kansas City, Mo. R. K. Bentzien has been added to the Milwaukee, Wis., sales office staff.

**Crowell Chemical Co.**, East Rutherford, N. J., has elected Stephen Dudiak chairman of the board.

**Baker-Raulang Co.**, Cleveland, has elected James W. Moran president. He succeeds E. J. Bartlett who becomes president emeritus and continues as a director.

**American Machine and Foundry Co.**, New York, has been appointed by the Guardite Corp., Chicago, sole overseas distributor of its vacuum moistening process.

**Dearborn Chemical Co.**, Chicago, has appointed William J. Tobin sales representative in the Minnesota territory. Roy O. Benson has been assigned sales representative to the Chicago territory. E. W. Houseknecht has been appointed sales representative in the Wisconsin territory.

**Gane & Ingram, Inc.**, 43 West 16 St., New York, has appointed Gerald S. Furman as vice president in charge of domestic sales.

**Worthington Pump and Machinery Corp.**, Harrison, N. J., has appointed Frank J. Whelan to supervise the sale of welding positioners and turning rolls manufactured at its Dunellen Works.

**International Paper Co.**, New York, has made Cedric Crain as its second district sales manager in Atlanta, Ga.

**Equipoise Controls, Inc.**, Mount Vernon, N. Y., has added Tarver S. Murphy, Jr., to its staff in the capacity of vice president to specialize in sales-engineering.

**Pittsburgh Plate Glass Co.**, Pittsburgh, Pa., has appointed Brooks M. Dyer as St. Louis district sales manager for its Columbia chemical division.

**Taylor Engineering and Manufacturing Co.**, Allentown, Pa., has added Henry A. Eckmann and Bayard S. Magee to its sales staff.

**McQuay, Inc.**, Minneapolis, has elected Philip S. Morris executive vice president and H. Blake Thomas vice president in charge of sales.

**Tennessee Eastman Corp.**, Kingsport, has appointed Duncan G. Carmichael technical representative for Eastman acetate dyestuffs with headquarters at the plant in Kingsport, Tenn.


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this list of WIGGINS GASHOLDER engineering and operating advantages when you think of storing chemical process gases, such as

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- ✓ Is unaffected by heat, cold, ice, snow, wind or rain—even earthquakes.
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- ✓ Has less than ½ of 1% dead space for quick purging.
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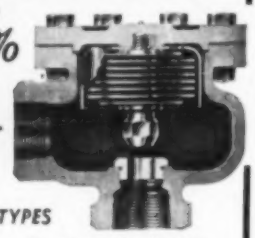
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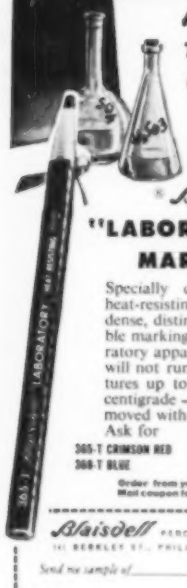
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# CONVENTION PAPER ABSTRACTS

CONTENTS

| | |
|---|---|
| 50,000 Diseases | 286 |
| Business and Government | 286 |
| Erosion Studies | 286 |
| Radiation Counters | 286 |
| Cotton vs. Synthetics | 288 |
| Process Design | 290 |
| The Disk Impeller | 292 |
| Employment Outlets Needed | 296 |
| Nucleonic Opportunities | 296 |
| Let There Be Light | 300 |
| Research Data and Decisions | 302 |
| Process Control | 304 |
| Lubricating Oil Improvers | 306 |

## *AGRICULTURE*

### 50,000 Diseases

R. J. Haskell

In the Department of Agriculture's experiment station at Beltsville, Md., there is just being completed the listing of the economic plant diseases known to occur in the United States. In that long list there are reported approximately 50,000 separate diseases on economic plants.

On corn alone there are listed 114 different troubles. On potatoes there are 127, on wheat 88, and on cotton there are 80 different maladies mentioned.

Several years ago it was estimated that the annual loss from plant diseases amounted to about $1,500,000,000. This figure was considered conservative at the time, and with a 40 percent increase in agricultural production, coupled with a 37 percent rise in the farm price index, the annual damage should now be more nearly $2,000,000,000, even with allowance for progress in disease control.

Royal J. Haskell, Department of Agriculture, before Delaware Section, American Chemical Society, Wilmington, Jan. 26, 1949.

## *MANAGEMENT*

### Business and Government

Charles Sawyer

Business and government have mutual obligations—what are the obligations of government to business? To mention a few:

1. Government owes it to business to remember that most of the country's economic needs should be taken care of by business, and that business should be given the greatest possible freedom in meeting these needs.

2. Government owes it to business to make certain services available to all business and to undertake for the good of all business certain activities that business cannot or does not care to undertake itself.

3. Government owes it to business—big business and small business—to enforce certain rules of fair play so that all businessmen can compete on the same basis and with no undue handicaps.

4. Government owes it to business to bring business into the councils of government and to work openly with business in the development of policies that affect the welfare of the economy.

Charles Sawyer, Secretary of Commerce, before Mississippi Valley Association, St. Louis, Feb. 7, 1949.

## *ENGINEERING*

### Erosion Studies

R. L. Stoker

Despite the widespread use of sand blasting for smoothing metal castings, basic scientific information on the effect of high speed dust particles on metal surfaces is surprisingly scarce. This effect has become extremely important with the adaptation of the fluidized solids technique to many industrial processes.

The latest processes for making synthetic gasoline call for fluidized catalysts—powdered minerals which speed the key chemical step.

To study dust erosion, pieces of iron were placed in front of a nozzle through which sand and dust particles were blown. Wear was greatest when the dust stream hit the iron at an angle of about 20 deg. Erosion also increased as the velocity of the dust was raised.

Plaster models can be used in place of iron or steel. Since the plaster wears down much more rapidly, the tests can be made more easily.

R. L. Stoker, University of California, before American Chemical Society, Cambridge, Mass., Dec. 29, 1948.

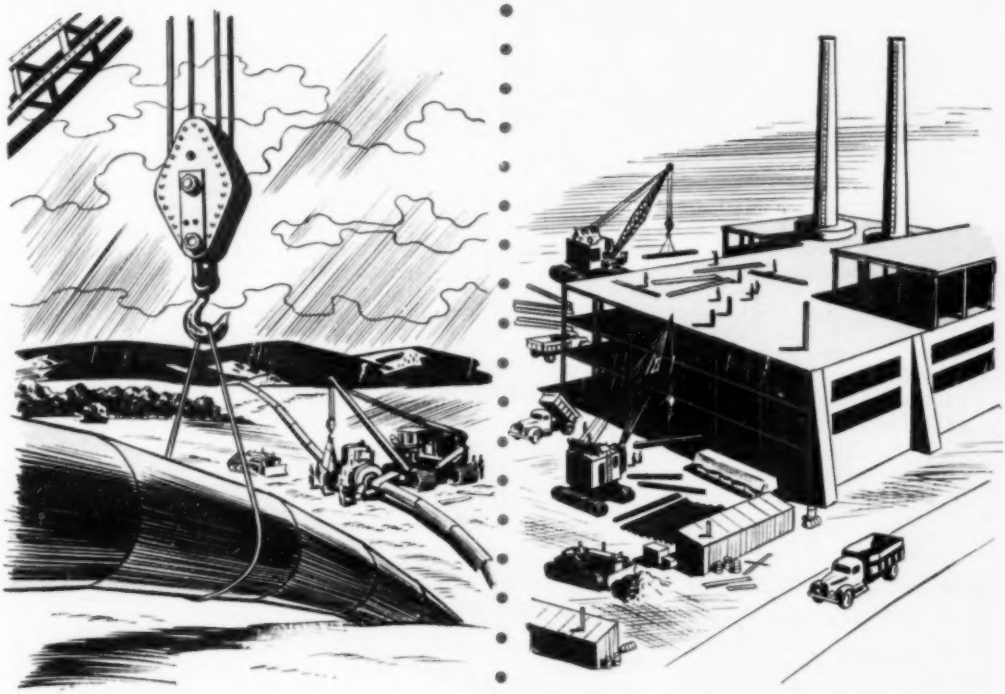
## *NUCLEONICS*

### Counters

Benjamin Schloss

A new device that excels the Geiger counter in measuring radioactivity will greatly facilitate the use of tracer isotopes in medical research. In place of the comparatively bulky gas cham-

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ber of the Geiger counter, the new instrument, called a crystal counter, utilizes a small crystal to trap and detect radiation.

Whereas the Geiger counter is an extremely inefficient instrument for detecting important gamma rays, registering only about one in a hundred, the crystal counter absorbs and records most of this type of radiation.

Among the other promising counting instruments now being developed are the Cerenkov counter, the scintillation counter, and the electron multiplier.

The Cerenkov counter, a Russian contribution to nuclear science, is based upon a peculiar effect of electrons moving through a medium at speeds greater than the velocity of light in that medium.

Radioactive particles bombarding fluorescent materials generate flashes of light, which are recorded by scintillation counters and although only alpha particles cause flashes bright enough to be visible to the naked eye, the light resulting from less powerful particles can be detected with an electric eye device.

The electron multiplier contains a number of plates, and when a nuclear particle strikes the first plate an electron is released which knocks an electron out of the second plate. The process is repeated, the energy of succeeding electrons being increased by an electronic circuit, until enough energy is built up at the final plate to permit detection.

Benjamin Schloss, Nucleonics Sales Co., before New York Section, American Chemical Society, New York, Nov. 20, 1948.

## *TEXTILES*

### Cotton Vs. Synthetics

R. B. Evans

In the last few years synthetic fibers and paper have come to offer stiff and growing competition to cotton. Rayon is fast increasing in use, due to improvements in quality and to publicity. The appearance of rayon staple fiber and high-tenacity yarn are notable examples of improvements in this material. Rayon is growing in use as a tire fabric, although cotton is still ahead. The rayon industry spends about $10 million annually in research, compared with a much lower outlay for cotton.

Nylon staple fiber is being placed experimentally on the market. Nylon can't compete with cotton on the basis of price, but is competing on the basis of special qualities. Paper is finding new uses, including the manufacture of drapery. Paper is dis-


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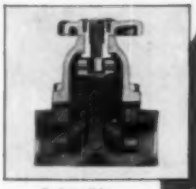
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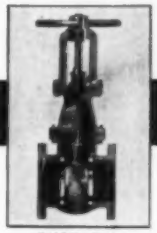


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Hard Rubber
Globe Angle Valve
1½"—50 psi.



Hard Rubber
Screw Type Ribb Cock
¼" to 1"—50 psi.



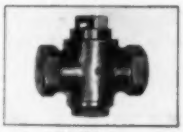
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Float Valve
½" to 1½"—50 psi.



Hard Rubber Screw Type
Straightway Cock
½" to 2"—50 psi.



Hard Rubber
Pet Cock
¼" to ⅜"—50 psi.



Hard Rubber
Screw Type Plug Cock
¼" to 4"—50 psi.



placing cotton as a bag material probably more rapidly than in any other product. In the last few years cotton yardage consumed in bags has been declining and paper consumption for that purpose is on the way up.

To improve the competitive status of cotton more research work must be done. Another means of helping cotton would be to improve the merchandising of cotton products.

R. B. Evans, Southern Regional Research Laboratory, before Southwest Regional Meeting, American Chemical Society, Shreveport, Dec. 9-11, 1948.

## PROCESS DESIGN

### Cooperation Needed

G. H. Burnett

As a new process is being developed the process design engineer concentrates on the chemistry or mechanics of the process. He knows the tolerances of manufacture and must be sure that each step in the process fulfills the chemical or mechanical requirements. Since new and more efficient process equipment is continually being designed, he must be alert to select the latest and best, otherwise the process may be obsolete before it is put into operation. It is common practice to consult with the equipment engineer of a manufacturer of dryers, filters or other specialized equipment, to obtain installation and operating information concerning a particular piece of process equipment before it is specified. Likewise, great care must be given to the selection of the measurement and control equipment. Many of the existing continuous processes would not be successful without the help of the industrial instruments and control equipment now commercially available. Also of significance is the fact that these modern control devices may not only be ineffective but may actually affect the process adversely if all factors and conditions surrounding their installation are not completely recognized and carefully considered.

As each step in the design of a process progresses, a study of the control requirements must be made in order to provide the degree of control which is required to meet the process and product specifications. Some degree of control, whether manual or automatic, is necessary and fundamental to the operation of any process. Almost every process presents some complex control problems which, by modern standards, require the specialized attention of a control engineer. It is he, who can best analyze every step in the process from a control standpoint to see that instrumentation, when specified, will be able to accomplish its in-





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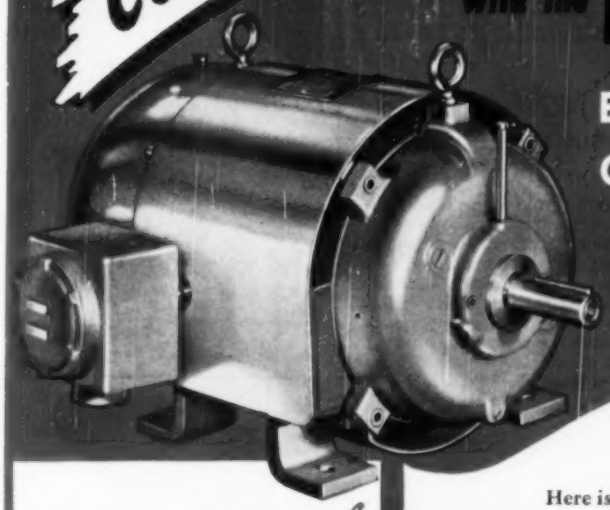
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The Totally-Enclosed Fan Cooled A-c. Motor for Applications where Chemical Atmospheres Prevail

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Underwriters' Class 1, Group D Explosion-Proof A-C. Motor

Here is the result of Reliance engineering applied to the problem of protecting motors that operate in either corrosive or explosive atmospheres. Frame and fan covers, fan, conduit box and end brackets are all made of selected corrosion-resisting materials. In addition, many extra steps are taken to achieve maximum protection, such as coating screws, counterboring screw holes and fitting-up with special compounds.

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tended purpose. Many times process equipment is purchased and the plant construction is well along toward completion before any concentrated study is made in order to provide the proper control equipment.

It is only by the coordinated efforts of the process, equipment, and control engineers that the ultimate can be reached in process design. Process equipment plus control equipment does not necessarily result in controlled process.

G. H. Burnett, Corn Products Refining Co., before American Institute of Chemical Engineers and American Society of Mechanical Engineers, New York, Nov. 8, 1948.

## *MIXING*

### The Disk Impeller

H. E. Serner

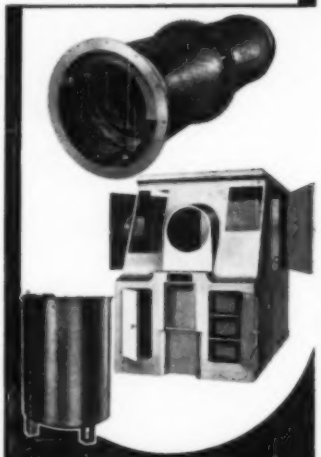
MANY of the very difficult processes such as heat transfer, fractionation, absorption, and others have been thoroughly explored and means for rational design approach have been made available. It is characteristic of most scientific investigations that more attention is paid to problems for which a need of solution is evident, than to those where the solution does not appear to be quite so necessary. Mixing, one of he oldest processes known to man, has until recently remained merely an art to be employed as best one can.

However, many of the countless devices and mechanical arrangements that are used for this purpose have been mechanically perfected to a high degree. But due to the fact that the basic principles of mixing have not yet been fully determined, little progress has been made regarding the development of new methods and means. Complete understanding of a process and the correct analysis of all factors involved are essential to its rational solution.

Mixing, in its usual forms, is a three-dimensional process, and in order to understand it better it must first be considered on a two-dimensional basis. A good example is the circular stone-mill. When two or more materials are fed between two flat surfaces, one of which is in rotation, the particles in contact with the rotating surface travel faster than those in contact only with the stationary surface, and a shear-plane is created between these two horizontal material layers. But since all particles also move toward the periphery of the stone-mill in a helical path, innumerable shear-planes are also created in vertical planes, and as a result the discharged product can be mixed in the proportion in which the materials are fed to the mill. The

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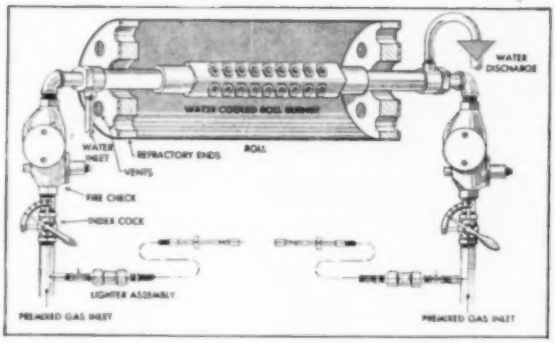
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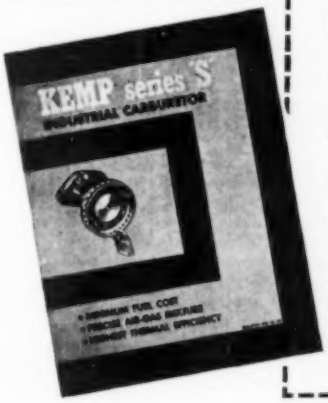
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Kemp Industrial Carburetors and Kemp Burners are the perfect combination for controlled efficient low-cost heat... for space-heating, ribbon-flame, or needle-point flame control.

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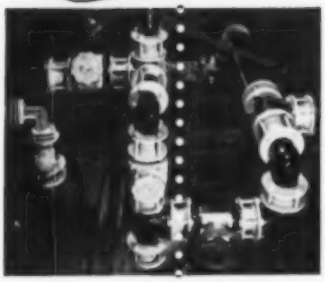
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HA-5-48

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stone-mill may be considered a good mixing device under certain operating conditions; materials are being mixed as they pass through the mill.

To enumerate the most important features of a good mixing apparatus: (1) The entire content of the mixing vessel must be properly agitated, (2) the most complex flow pattern must be created, (3) The impeller itself must be able to effect as much mixing as possible.

It is not difficult to accomplish most of this when the materials have low viscosities and are miscible. When some of the components of the mixtures are solids and when high viscosities are encountered, then the problem becomes more difficult.

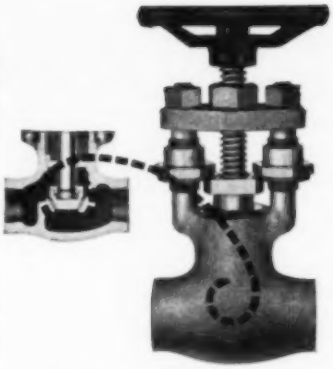
The disk agitator has been developed for the purpose of overcoming some of the limitations and shortcomings of conventional agitating and mixing devices.

The disk impeller consists solely of two or more parallel disks, mounted on a central shaft—similar to a turbine. The disks are more or less closely spaced. This impeller imparts motion to the surrounding fluid only by the surface friction that exists between the disk surfaces and the liquid films with which they are in contact. The action of this device is somewhat surprising. In the case of low viscosity, water for instance, the discharge velocity from the disk-impeller can be higher than half the peripheral speed of the disks, but it can be reduced to almost the lowest desirable velocity by merely increasing the spaces between the disks. On the other hand, when the viscosity of the fluid is somewhat higher, it is possible to create a discharge velocity substantially equal to the peripheral speed of the disks.

But the greatest advantage of this device when used for the purpose of mixing, is in the peculiar flow characteristics of the fluid passing through this impeller. The fluid films in direct contact with two opposed disk-surfaces travel faster than the central portions of the liquid layer. As the liquid travels from the center to the periphery of the impeller in a helical path, its motion is continuously accelerated.

Therefore, the radial velocity differs with the distance from the center. The result is a very complex type of differential flow which effects a rapid and intense shuffling of the fluid particles.

In most industrial applications the disk impeller consists of several disks. The fluid passing through this impeller is therefore cut into a number of separate layers which diffuse into each other after being discharged. This high velocity discharge stream



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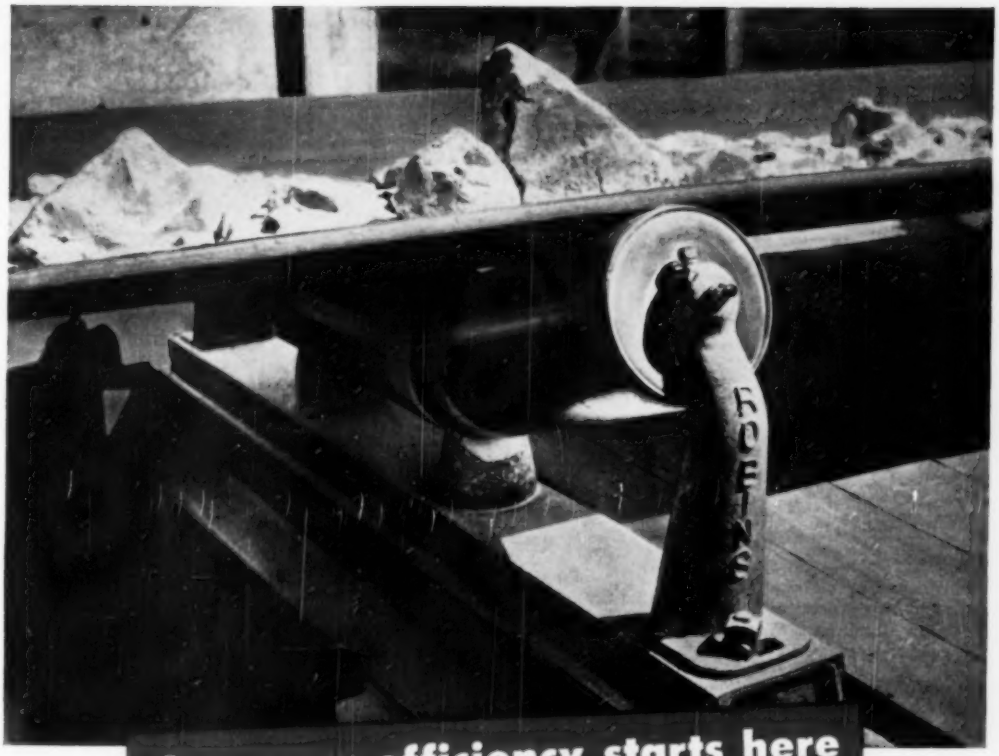
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Since 1877 "HANCOCK" has meant valve quality and performance in the highest degree. And now that all HANCOCK WELDVALVES are built with integral stellite seats, you may install them, forget them and be sure that utmost economy follows your judgment.

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# Conveyor efficiency starts here

Your conveyor can be no better than its idlers!

For the idlers must do two things: (1) They must withstand severe usage. (2) They must keep your conveyor belt tracking properly. Otherwise, your entire conveyor can break down.

Yes, efficient idlers are vital to top performance. And because Hewitt-Robins Conveyors are equipped with Robins Idlers, you can depend on them to *move your material at less cost.*

You see, Robins Idlers provide *extra strength.* The reason is their rigid truss design. It is stronger than any other type of construction!

Robins Idlers provide *extra economy,* too. That is due to such features as their patented One-Shot Lubrication and Triple Grease Seal. These enable Robins Idlers to roll longer . . . with less care and less grease!

Here's an additional fact to keep in mind when you buy a conveyor:

**Hewitt-Robins is the only company in the world that assumes complete responsibility for both machinery and belting. Only Hewitt-Robins engineers builds and installs these elements as a single unit.**

Whether you need replacement idlers for your present conveyor or an entirely new conveyor, insist on Robins Idlers. For full details, write Robins Conveyors Division, 270 Passaic Avenue, Passaic, New Jersey.

**ROBINS IDLERS**

ROBINS CONVEYORS DIVISION

## These exclusive features of Robins Idlers save you money

### *One-Shot Lubrication*

Cuts your lubricating time more than half. Assures thorough lubrication with only one walkway on your conveyor. No exposed piping subject to damage.

### *Triple Grease Seal*

on Robins Roller Bearing Troughing and Return Idlers. Locks grease in. Keeps dirt and moisture out.

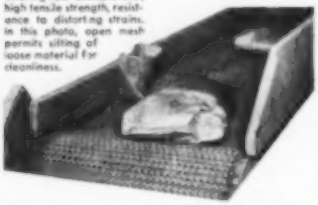
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creates a jet action on the surrounding fluid which greatly increases circulation and turnover of the contents of the mixing vessel.

H. E. Serner, Davidson & Serner, before Federation of Paint and Varnish Producers Clubs, Chicago, Nov. 6, 1948.

## *EDUCATION*

### New Employment Outlets Needed

Clement J. Freund

ENGINEERING college enrollments have risen sharply from 9,000 in 1926 to an anticipated 70,000 in 1950. The engineering industries of the United States can absorb the sudden flood of veteran graduates during the next three years. However, in order to do so, certain additional outlets need development.

Heretofore, engineering graduates and college placement officers have concentrated almost exclusively upon familiar positions in design, experiment and test, sales, research and a few others. They have more or less neglected positions in plant engineering and maintenance, production and manufacturing, and the operation of plant facilities of whatever kind.

Again, comparatively few small industries have engaged engineers. There are countless openings in thousands of small industries for practically an unlimited number of young engineers.

However, in order to break open all these outlets, it will be necessary for the engineering faculties to establish much closer relations with the industries, and this applies particularly to the teaching members of the faculties rather than to the personnel officers.

Clement J. Freund, University of Detroit Engineering College, before Engineering College Administrative Council, Washington, Nov. 7, 1948.

## *NUCLEONICS*

### Chemical Engineers in the Atomic Energy Industry

W. M. DeCew

ON FEW other questions are there so many misconceptions as there are on the role of the chemical engineer in the atomic energy industry.

First, there is the common belief that no atomic energy project can function without the presence of a Nobel prize winning scientist, or at the very least, without the cooperation of several nationally known nuclear physicists. Second is the idea that atomic energy is so complex, mysterious, unprecedented and so young that conventional engineering

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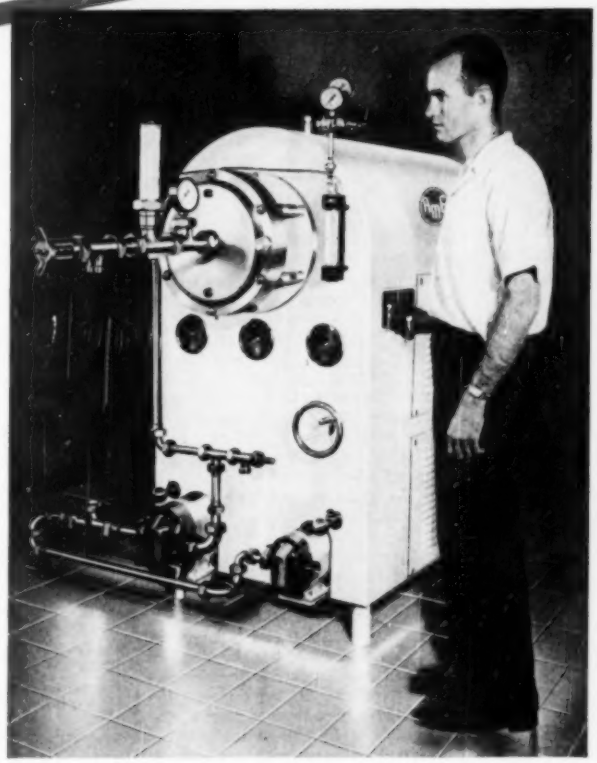
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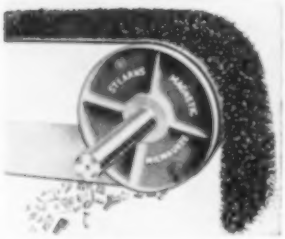
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**However, for certain light duty applications, Stearns Permanent Magnetic Pulleys (shown above) may be used. The best permanent magnetic pulleys money can buy, they require no wiring, are easily installed and eliminate operating expense.**

**Consult Stearns Magnetic for recommendations on your particular problem. Write for Bulletin 303 on Electro-Magnetic Pulleys or Bulletin 350 on Permanent Magnetic Pulleys.**

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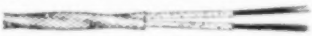

and industrial procedures cannot be applied to it. Another common assumption, related to the first two, is that the so-called nuclear engineer requires very advanced training in nuclear physics and higher mathematics. Finally, there is the widespread illusion that the Atomic Energy Commission has developed on its projects a number of important technical advances, which they are keeping secret from the Russians and the American public.

Although it is true that the theory of nuclear reactor design, that is to say the design of atomic piles for the production of fissionable materials and nuclear power, was invented by theoretical nuclear physicists and has been developed to a considerable degree of complexity by them, the concepts involved are relatively simple. It is possible to do creative engineering development without a thorough mastery of more specialized extensions of the subject. Experience has shown that a good development engineer and particularly a chemical engineer, can become an expert in the design and construction of nuclear reactors, with not more than a year's training in atomic energy.

The development of nuclear power is principally an engineering problem. In fact, more is probably known today about the science of nuclear reactors than is known about the basic mechanisms of petroleum refining or the processes for synthetic rubber manufacture. About 90 percent of the design and construction of nuclear energy plants is based on the straight-forward application of conventional engineering principles and procedures. In working out the design of a new type of reactor, the first step is to choose materials of construction in relative proportions, and to make a trial solution for critical size, breeding ratio, and other quantities. Although this requires a certain knowledge of neutron physics and partial differential equations, the problem is of no higher order of difficulty than other theoretical engineering problems encountered by chemical engineers in other industries. When an approximate design basis has been arrived at in this manner, the next step is to make a more detailed design of the actual pile lattice structure. The neutron density at various positions in the lattice is then found by means of neutron diffusion theory. This involves solution of the appropriate diffusion equation with boundary conditions dictated by the geometry of the reactor. The power level of the pile is a partial function of the neutron flux density. After this, and similar basic pile calculations have been verified (and this can only


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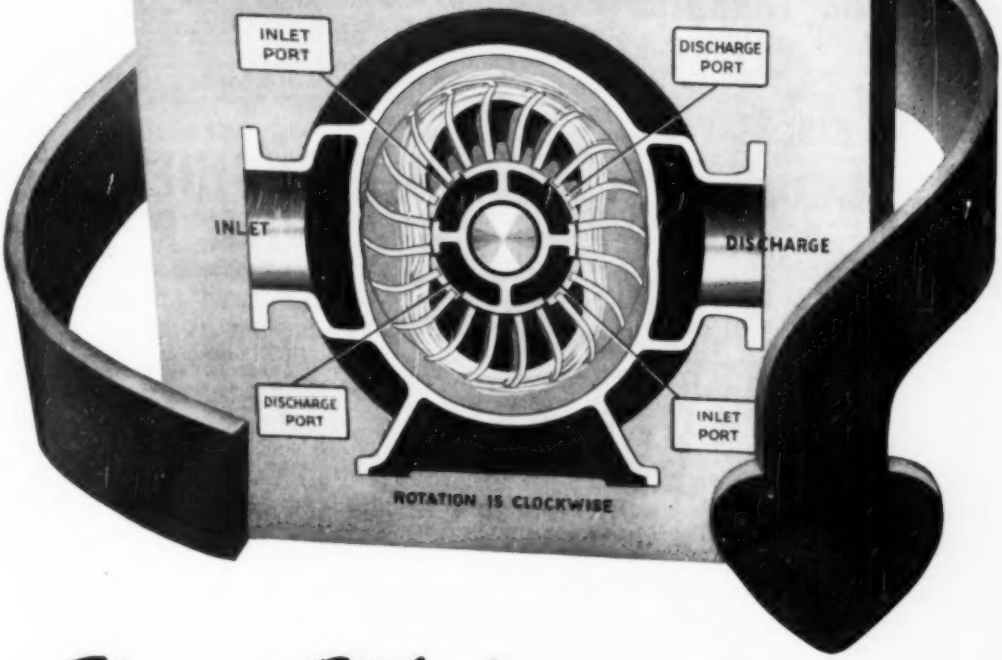


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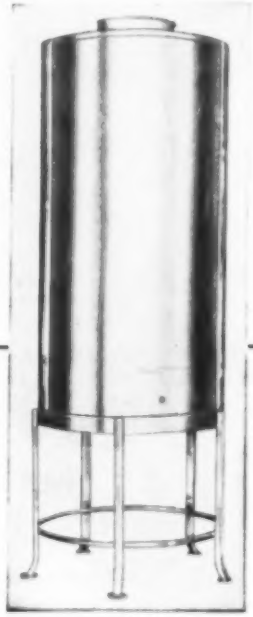
You can dispense with oil filters and dust filters when you install ®Nash® Clean Air Compressors. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

®Nash® Clean Air Compressors are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now.

**No oil filters.**
**No dust filters.**
**No internal lubrication to contaminate air handled.**
**No internal wearing parts.**
**No valves, pistons, or vanes.**
**Non-pulsating pressure.**
**Original performance constant over a long pump life.**
**Low maintenance cost.**

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be done by cut-and-try engineering experimentation), the design of the complete nuclear energy plant reduces to the design of an integrated continuous process for heat transfer, extraction and separation of fission products, metallurgical processing, and recycling of the fissionable material.

Process design for a nuclear energy plant, as in any other chemical plant, must be guided by economic factors. In operation the economics of a nuclear energy plant would be similar to that of a continuous flow power plant and oil refinery. The pure fissionable material produced as a by-product by a breeder reactor, for example, would be salable as a valuable fuel, along with other byproducts, such as tracer isotopes and secondary gamma-ray sources. It may turn out that only single-purpose reactors are of any use, that is, reactors designed to produce power or fissionable material, but not both. Or, on the other hand, the simultaneous production of power and fissionable material may be the most economic possibility. The economic balance will have to be determined competitively through the interplay of many branches of engineering and industry.

Walter M. DeCew, *Nucleonics*, before Columbia University Student Chapter, American Institute of Chemical Engineers, New York, Nov. 19, 1948.

## *MANAGEMENT*

### Let There Be Light

J. D. Wise

BUSINESS management is a public trust. It must conduct itself so that it will have the right to ask for public confidence. It must speak freely, give information gladly and answer the attacks of those who seek under any guise to undermine our economy.

Almost 100 years ago Macaulay wrote of his fears that America would lose its form of representative government by demogogic appeals to class selfishness, greed and hate. He wrote, "When a society has entered on this downward progress, either civilization or liberty must perish. Either some Caesar or Napoleon will seize the reins of government with a strong hand; or your republic will be fearfully plundered and laid waste by barbarians in the 20th century as the Roman Empire was in the 5th;—with this difference, that the Huns and Vandals who ravaged the Roman Empire came from without; and that your Huns and Vandals will have been engendered within your own country by your own institutions!"

That day will never come if we have the broadest possible true understand-


*For low-cost performance of*
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*. . . use these practical application and maintenance aids*



Here's a handy reference that gives you a thorough analysis of the engineering, design, application, and maintenance principles you must take into account when working with rubber in industry. Whether you're an engineer—designer—shop superintendent—industrial technician—no matter what your link with the rubber field . . . you'll find this concise treatment of the physical and chemical properties of rubber compounds a handy and practical guide.

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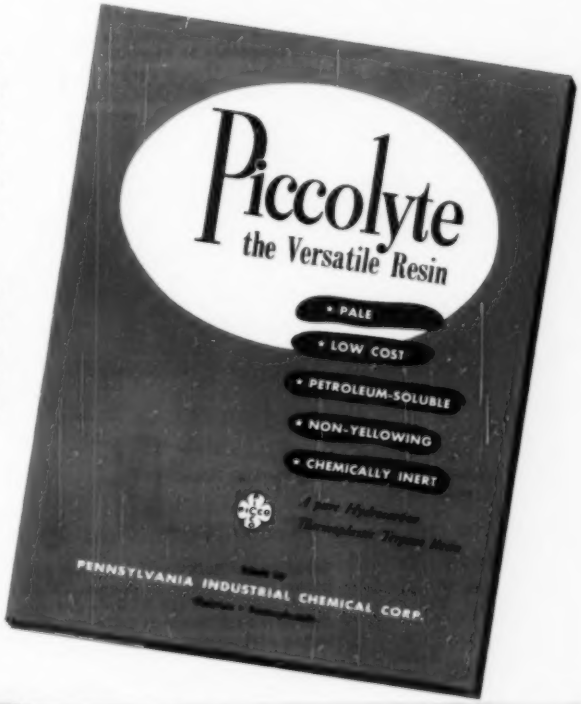
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ing of our social and economic system. There is a doubt among many people that our system is able to cope with the social and economic problems that lie ahead. Some think—in fact ½ of our population thinks—that they would be as well off under government ownership and operation of industry as under private enterprise. Others fear that our way of life will collapse under the combined effects of paralysis within and assault from without.

In the face of America's achievements these beliefs and fears are almost incredible. But they exist and the job of each of us is to do his part to dispel these doubts and fears through a true understanding of our society. Business management has a deep responsibility in the way it conducts itself to see that this heritage is improved and not destroyed.

James DeCamp Wise, Bigelow-Sanford Carpet Co., before business and civic leaders, Amsterdam, N. Y., Oct. 28, 1948.

## *MANAGEMENT*

### Research Data and Decisions

R. L. Davies

One method of conducting market research in chemical companies is by setting up in advance in a uniform pattern the types of facts which would be important in making management decisions. In this system it is at all times acknowledged that this picture cannot be fully completed by the time the management decision has to be made. The procedure is, therefore, to keep inserting facts into their appropriate sections in the pattern up until the time when the decision has to be made. The decision is then taken on the basis of whatever facts and estimates have been established, together with the knowledge of what specific types of information are still lacking.

This method, which has been used successfully for market research activities, is now proposed for technical research activities. It would be used for technical research investigations which are for the purpose of providing the important facts necessary for making management decisions. The types of facts required for such decisions would be set up into a pattern, and technical data would be filled into the pattern as secured.

It would be acknowledged that just as in market research, so in technical research, the pattern can never be fully completed by the time a management decision must be made. Thus, instead of the management decision often having to be made without any technical research report, or having to be delayed unduly for the "completion" of the conventional report, the decision

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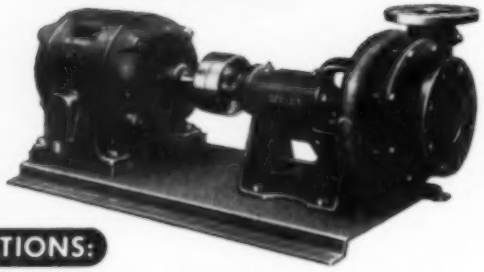
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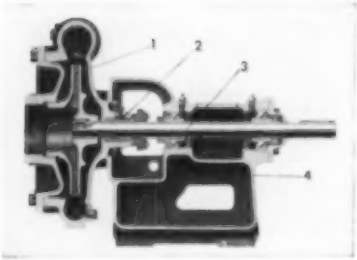
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could be taken at the opportune time on the basis of whatever facts and estimates have been established, together with the knowledge of what specific types of information are still lacking.

R. L. Davies, Pennsylvania Salt Manufacturing Co., before Philadelphia Section, American Chemical Society, Philadelphia, Jan. 20, 1949.

# *PROCESS CONTROL*

## Dynamic Characteristics Of Process Plants

J. B. McMahon and R. A. Ackley

Process factors which affect the successful application of automatic control may be grouped under three classes: (1) Selection of criteria of process conditions; (2) self regulation; (3) process lags.

The purpose of applying automatic control is to produce products of definite specifications—physical, chemical or both. It is rare, however, that it is possible to apply measurement directly to these factors, and therefore it becomes necessary to select process variables for measurement and control which vary quantitatively with the desired properties. Even where analytical type measurements may be applied to the final product, it is generally necessary to resort to the measurement and control of variables throughout a process to which the composition of the final product bears a significant relation and which are substantially linear within the operating range. Some physical effect of chemical change such as temperature, pressure, conductivity, or pH may be used. Most other measurements and automatic control applications are made in order to maintain the physical inventory throughout the process in balance, or for the purpose of providing time for chemical reactions or physical changes to take place.

Discontinuities in operation, whether of measurement or automatic control action, are about the most bothersome factors to deal with. It is highly necessary, there, that the variables selected for measurement for automatic control purposes be truly representative of changes in process conditions.

Chemical reactions may or may not produce self-regulating effects. Generally speaking, endothermic reactions assist equilibrium, while exothermic reactions tend to produce dis-equilibrium. If heat must be supplied to cause the reaction to proceed, then an increase in speed of reaction will not cause an increase in temperature, although it may permit a higher temperature. If, however, increased speed of reaction causes increased temperature, which further increases speed of




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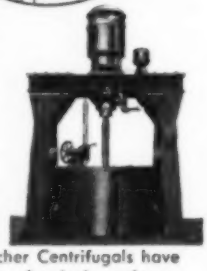
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The "Centroid" is another reason why Fletcher Centrifugals have thoroughly proved themselves with exacting chemical engineers throughout the country.

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reaction, the tendency towards disequilibrium is self-perpetuating.

The tendency of processes to come to equilibrium, which may be termed "positive self-regulation," is of great assistance in producing successful automatic control. Every process should be carefully studied while in the design state in an effort to determine what tendencies exist and if at all possible, to assure positive self-regulation throughout.

Under balanced operating conditions, there is no analyzable necessity for automatic control in the ordinary continuous process. It is only because of interferences with or upsets to balanced conditions that automatic control becomes necessary. The function of automatic control is to prevent deviations from balance, or restoration to balance as quickly as possible. Since the process affects the automatic control at the same time that the automatic control is affecting the process, the dynamic response of the process to the restorative action of the automatic control must be taken into account.

The time relation between deviation of the measured variable from the desired value and its response to corrective action determines the ease or difficulty of either manual or automatic control. It is worthy of note that manual and automatic control are not equally feasible. Automatic control properly selected and applied may easily take care of applications which are difficult, if not impossible, to control manually; and many applications may be handled with comparative ease on manual control which are very difficult for automatic control.

J. B. McMahon and R. A. Ackley, Republic Flow Meters Co., before the American Society of Mechanical Engineers and American Institute of Chemical Engineers, New York, Nov. 8, 1948.

## *PETROLEUM*

### Lubricating-Oil Improvers

A. B. Boehm

EXCEPT for some minor use of oiliness agents, the additive business may be said to have started in 1931, with the introduction of pour depressants. In 1936 the use of additives in automotive oils was expanded by the introduction of the first commercial bearing corrosion inhibitor, the first detergent-type additive for diesel oil, and the introduction of a viscosity-index improver. Extreme-pressure gear-oil additives entered the picture in 1938, and a year or so later additives for all-purpose heavy-duty motor oils were available.

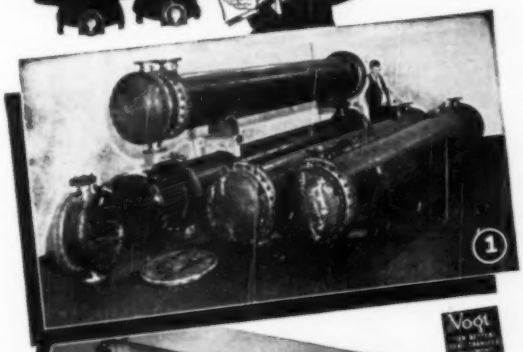
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# *Fighting* TOUGH Corrosion

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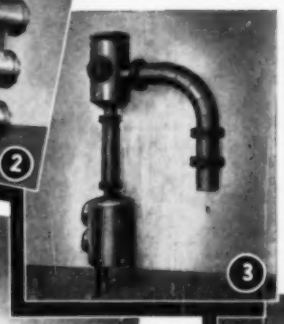


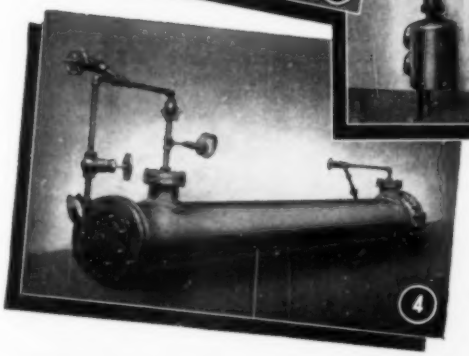









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practically nothing to a position of an important and substantial supplier to the lubricating-oil manufacturing industry. To give a further slant on the growth of the additive business, we estimate that the production of lubricating-oil additives has now reached a rate somewhere between 1,400 bbl. and 1,500 bbl. per day—with an annual value in the order of $35,000,000.

Pour depressants are serving the industry well—and economically. Today there are five different pour depressants marketed by three companies. Manufacturing capacity is ample, and supply is reliable.

Viscosity index improvers have been in extensive and continuous use for the compounding of motor oils and hydraulic oils for the past 12 years. These additives are polymers which have been carefully developed so as to give true solutions in lubricating oils.

The application of inhibitor detergents to motor-oil improvement is important because the oil industry is putting more money into additives and additive testing for this purpose than for any other lubricating-oil development. It is also important because the additive treatment of motor oils has not been too well understood, and there are some rather divergent views within the industry as to what is needed.

Engine deposits resulting from low-temperature operation are properly related to fuel quality and engine cooling or ventilating, rather than to lubricating-oil quality. Yet there is growing evidence that this problem can be relieved by the use of suitable inhibitor-detergent additives.

Other additives are of minor importance from a volume standpoint, although there are a few which serve highly useful ends.

Moderate temperature oxidation inhibitors are used in turbine oils, hydraulic oils, transformer oils, and in any highly refined oil which is not exposed to high temperatures and which is called upon to stay in service for a long time. Well-known products have been giving excellent service in this sort of industrial oil applications for many years. Inhibited turbine oils have been in continuous service 8 to 10 years—with only makeup oil added.

Additives used to reduce friction or add film strength are now principally applied to various industrial oils, but they may come in for expanding use in the automotive field in the future. Another industrial oil additive contributes stay-put qualities which are highly valued in applications such as textile machinery lubrication and the like.

Finally, we have the aesthetic group;




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viz., color stabilizers and color correctors. With these the color of an acid-treated pale oil can be held constant during storage, a pale oil can be cheaply converted to a red oil, or a blue cast can be converted into an eye-appealing green.

A. B. Boehm, Enjay Co., before American Petroleum Institute, Chicago, Nov. 10, 1948.

## FOREIGN LITERATURE ABSTRACTS

### Lubricating Oil From Ethylene

A PILOT plant for polymerization of ethylene to lubricating oil was planned on the basis of extensive experimental work and was put into operation in Leuna in 1937. The procedure used in this 700-tons-per-year plant is shown in the accompanying flowsheets. A dissociation gas containing 30 percent ethylene was produced from the ethane of hydrogenation waste gas by dissociation according to the method developed by Dr. Klein of I. G.-Werk Oppau. This diluted ethylene was concentrated to 99.5 percent in a Linde plant with three distilling columns. A washing plant must be introduced between the dissociation plant and the Linde plant since side reactions take place during ethane dissociation in addition to the dehydrogenation process; these lead to the formation of liquid products which must not enter the Linde plant where they cause disturbances. This was arranged as follows: the dissociation gas was compressed to about 0.5 atm. above atmospheric by means of an Elmo pump, washed with an aqueous soda solution, and then freed of acetylene in a hydrogenating furnace. Then it was compressed to 15 atm.; freed of its liquid hydrocarbon constituent in an oil bath; and passed into a tower filled with active carbon in order to eliminate the last traces of liquid products. The carbonic acid was then eliminated, and the last traces of $CO_2$ washed out in a subsequent soda lye wash. The gas then entered the Linde plant.

Pure ethylene leaving the Linde plant was compressed to 200 atm. and conducted to the polymerization plant. This consists of two autoclaves, each with a content of 1,000 liters (diameter, 500 mm.; length, 5,000 mm.). They are made of $N_e$-material. The contents are stirred by means of a Hösch agitator, which is introduced


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**DISSOLVER**
**Faster because it develops laminar interface shear**



Model A has a tank especially designed for the Cowles Ultra-Fast impeller. Available with a heat exchanger in the base, it increases solubility, reduces undissolved residues and is easy to clean.

Two to twenty times faster than conventional mixers, the Cowles Ultra-Fast Dissolver has an impeller of advanced design that sets up components of laminar flow, producing interface shear between multiple laminae with a high velocity gradient. The combined area of the many surfaces exposed to the shearing action plus the thinness of each laminae, subjects every particle in the batch to shear and scrubbing forces, greatly accelerating the dissolving and dispersing action.

Practically pure solutions and intimately-mingled colloidal dispersions are produced. There is no wait for undissolved residues or suspended solids to go into solution . . . no slow feeding . . . no clumping or balling of the dispersed medium in process. Splash and dead spots are virtually eliminated.

### *Safe, Silent, Long-Wearing*

A high degree of balance in the rotating parts, coupled with rubber mountings, eliminates noise and destructive vibration. The rugged structure of the machine, the proved quality of the bearings and motor, all insure long life and low maintenance. For volatile and flammable solvents, solutes or sols, an explosion-proof motor, non-sparking tank and impeller—each adequately grounded for extra safety—are available.

### *Tanks and Removable Tank Models*

The Cowles Dissolver is available from stock with tanks of 100 gal., 250 gal., or 500 gal. capacity; also in models for use in tanks or containers brought to the machine. Motor speed, horsepower and design of impeller are all adjusted to the gallonage, viscosity, physical and chemical properties of the materials you wish to process.

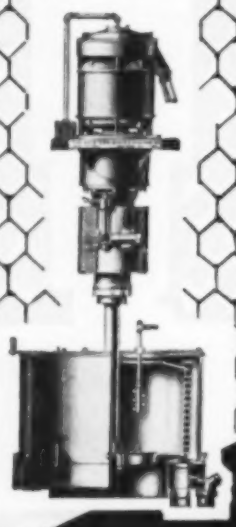
**Tell us what your problem is. Write for a descriptive folder . . . or ask for a technical representative to discuss the matter with you. No charge. No obligation.**

YEARS OF COMMERCIAL TEST SHOW COWLES DISSOLVER UP TO 10½ HOURS FASTER ON TYPICAL OPERATIONS

| Type Operation | Material | Cowles Dissolver | Standard Mixer |
|---|---|---|---|
| Gum Cutting | Rosin | 1½ Hrs. | 12 Hrs. |
| Synthetic resin dissolving | Vinylite | 1 Hr. | 6 Hrs. |
| N/C solution | Nitrocellulose | 12 Min. | 90 Min. |
| Tinting | Enamel | 5 Min. | 30 Min. |
| Pigment dispersion | Heavy Enamel | 6 Min. | 150 Min. |
| Coating suspension | H. T. Clay | 1 Hr. | 9 Hrs. |

The Cowles Company
INCORPORATED
CAYUGA, N. Y.

THE ROBERTS FLUID DRIVE
CENTRIFUGAL
IS REALLY A HONEY



In this machine and in this machine alone are the following features to be had:

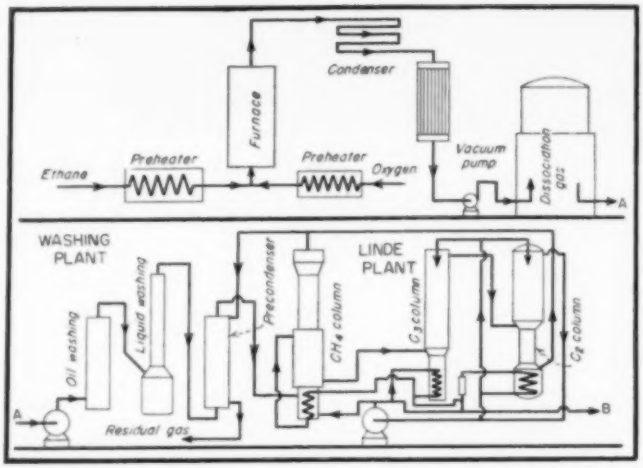
*Standard motor*, with current peak less than 40% of direct connected (special) motor drives.

*Uniform torque . . . adjustable* application.

*Simple* adjustment for accurate speed control.

***And further,*** the inherent design of the Roberts Fluid Drive Centrifugal allows special characteristics to be incorporated with ease, thus suiting it exactly to your individual application. Your inquiry will have our full and prompt attention.

ROBERTS
The
WESTERN STATES
MACHINE COMPANY
HAMILTON, OHIO, U.S.A.



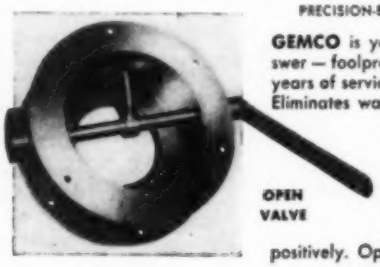

Pure ethylene (99.5 percent) preparation in German 700-ton-per-day plant for production of lubricating oil from ethane. (Flowsheet continued on p. 514.)

into the autoclave from below; the contact material was introduced through the top flange while the gas was led in and the crude polymer led out through the bottom flange. The autoclave was heated and cooled by a water jacket.

Polymerization of the pure ethylene proceeds as follows: the first light oil (from a preceding polymerization) and aluminum chloride are put into the autoclaves with stirring. After the autoclaves are closed, the ethylene is brought to a pressure of 20 to 35 atm. The reaction of ethylene with aluminum chloride is started by heat-

GEMCO SPHERICAL DUST-TITE VALVES

*Assure Improved Plant Methods on*
**BINS, HOPPERS, BLENDERS, PIPELINES**



OPEN VALVE

PRECISION-BUILT FOR *Your* JOB!

**GEMCO** is your once-for-all-time answer — foolproof, efficient, built for years of service. Saves time and labor. Eliminates waste and troubles of old-style slide gate valves.

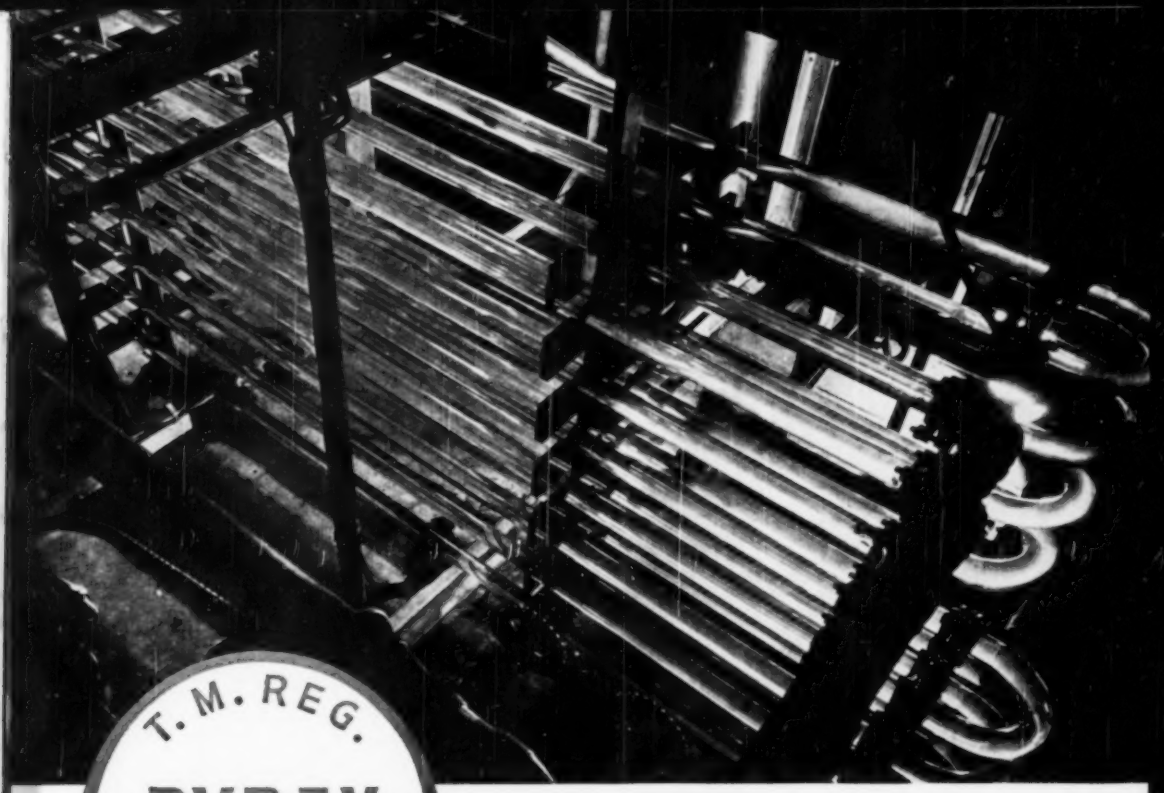
• The sharp disc cleans the seat and prepares it for smooth, quick, continuous action. Quarter-turn opens full or closes positively. Openings from 2" to 16".

***For dry powders, crystals and pasty materials. NO STICKING, NO SIFTING, NO DUSTING.***

Made, as per requirements, in cast iron, aluminum, stainless steel, monel, everdur, copper, or bronze.

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PYREX

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# *Heat Exchangers*

## THE PRACTICAL ANSWER TO SEVERE OR SENSITIVE SERVICE REQUIREMENTS

Less expensive than any other material that withstands severe corrosion or protects your products from metal pick-up, PYREX brand glass No. 7740 is being used on a larger scale than ever in the form of heat exchangers. If your process is severe or your product subject to deterioration through impurities, PYREX Heat Exchangers may solve the problem.

Highly resistant to practically every acid and mild alkalies, PYREX brand glass eliminates corrosion, inside and out. This means you can use any coolant, such as sea water, with substantial savings for its treatment. A low expansion glass, PYREX possesses high thermal and physical shock resistance. Unmatched visibility affords complete check of the operation.

Two types of heat exchangers are obtainable with PYREX—cascade and jacketed. Sizes range from 1″ to 4″ I.D. with lengths up to 150″. Flanges and gaskets are identical to those used for connecting glass pipe. Construction is tried and proven. For further information, write us at Corning.

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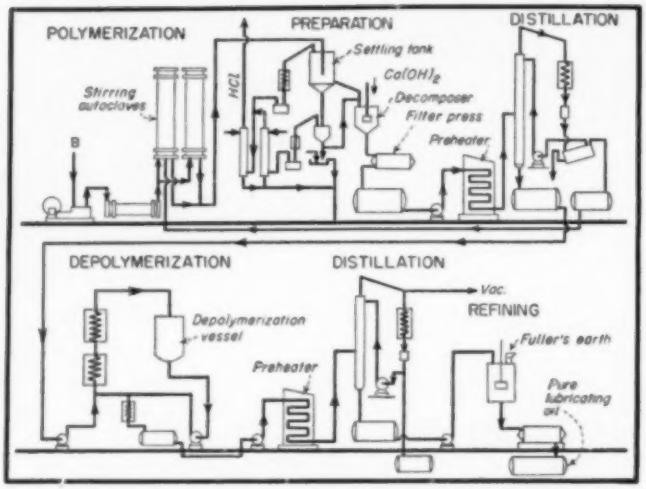
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Division of

Orange Roller Bearing Co., Inc.

564 White Street

Orange, N. J.




Steps in the German method for production of a synthetic lubricating oil. Capacity reached 10,000 tons in 1942. (Flowsheet continued from p. 312.)

ing, whereupon there is a sudden rise in temperature. After attaining maximum temperature, it is quickly cooled to 110 deg. and additional ethylene is introduced at 110 to 115 deg. at a rate of some 100 to 300 cu.m. per hr. The autoclave is filled after some 6 to 8 hr., depending on the purity of the ethylene, fullness being indicated by a rise in the thermo-element installed in the top flange inside the autoclave.

The autoclave contents are now discharged into a stirring tank, the predecomposer. The dissolved gases escape

ASCO Solenoid VALVES

Stainless Steel "Sanitary" Valve Type—DJQ



This particular ASCO Solenoid Valve is ideal for controlling the flow of material in connection with batching operations. Coupled with its "cleanability" feature is its reliability. Fully automatic, it opens and stays open as long as the coil is energized; it closes and stays closed when it is de-energized. Several pipe sizes available.

Write us about your automatic control problem in connection with the flow of liquids or gases, mentioning size of pipe, nature of materials and pressure. If this valve doesn't fit the picture, we have scores of other designs from which to select.

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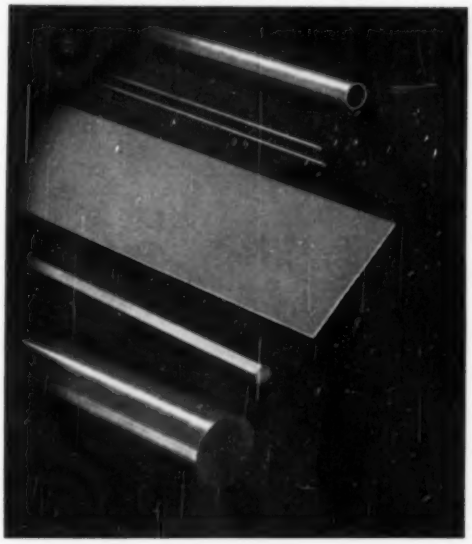
Automatic Switch Co.

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# NOW *Carpenter* Stainless No. 20 to Resist Sulphuric Acid!

***Now a New Stainless Steel Ready to Take on New Jobs***

*Carpenter Stainless No. 20 is available in the forms of bar stock, wire, strip and tubing.*



Here is news about a highly corrosion-resistant alloy available for the first time in the forms of bars, wire, strip and tubing.

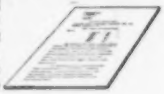
In the past, the alloy has been available only in the cast form, known as Durimet 20. Now that Carpenter has overcome the problem of producing this alloy in the wrought form, its usefulness in solving corrosion control problems has been greatly increased.

There are two general types of applications in which Carpenter Stainless No. 20 can provide new and increased economy. First, in processes where sulphuric acid solutions are present at various temperatures and in various concentrations. And second, in handling other highly corrosive acids and solutions where an extra margin of safety is required, over and above the corrosion resistance provided by other types of Stainless Steel.

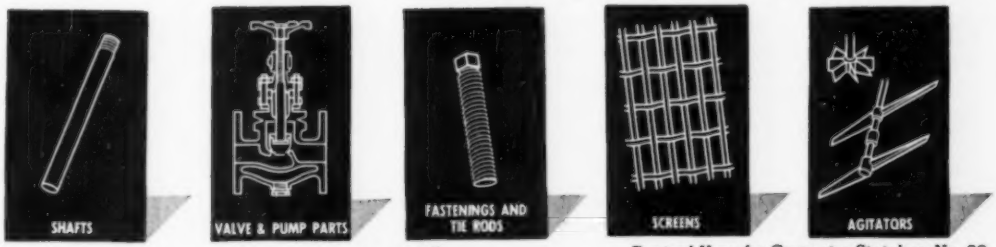
If you care to investigate the corrosion resistance of the material under actual operating conditions, we will be glad to work with you on sample orders.

**Corrosion Resistance and Physical Properties Data . . .**

These data pages will give you useful information on Carpenter Stainless No. 20 and the jobs it can do. For your copy, just drop us a note on your company letterhead, indicating your title, and ask for the Carpenter Stainless No. 20 data pages. We will be glad to put them in the mail for you.



**THE CARPENTER STEEL COMPANY, 127 W. Bern St., Reading, Pa.**




*Typical Uses for Carpenter Stainless No. 20*

Carpenter

## STAINLESS NO. 20

LICENSED UNDER PATENTS OF THE DURIRON CO., INC.

Carpenter Stainless No. 20 Tubing and pipe sizes produced by Alloy Tube Division, The Carpenter Steel Co., Union, New Jersey



# Pangborn Stops Dust

## where Universal Electrical Products are made . . .

At Landers, Frary and Clark, New Britain, Conn., profits depend on efficient production of their famous *Universal* Electrical Products. And . . . their efficient production depends in part on Pangborn Dust Control, for damaging dusts produced by milling machines such as the one shown at left could play havoc in the plant if they weren't collected at the source.

To guard products and machinery, and to insure good industrial housekeeping, this manufacturer of *Universal* toasters, waffle irons, mixers, heaters, irons and fans turns to Pangborn Dust Control to stop the Dust Hog.



Dust is collected at the source through exhaust hoods installed on the milling machines. Then it's conveyed through ducts to a Pangborn "CH" Collector outside the building where it is stored for convenient disposal.

**If you have a dust problem,** let Pangborn help you solve it. No matter whether you want to improve plant working conditions or efficiency, increase product quality, reduce machine maintenance or recover valuable dust by-products, a Pangborn Dust Control System, tailored to the job by Pangborn engineers, is the positive way to solve it.

**Let us make a dust pocket survey** in your plant. There's no obligation or cost to you, but it will enable us to recommend the right Pangborn Equipment to help your production. Write for information and get your free copy of "The Control of Industrial Dust." PANGBORN CORPORATION, 283 Pangborn Blvd., Hagerstown, Maryland.

*Look to Pangborn for all the latest developments in Dust Control and Blast Cleaning Equipment.*






**STOP THE DUST HOG**

**from stealing profits with**

**Pangborn**

**DUST CONTROL**


here and the crude polymer is conducted into centrifuges with continuous addition of acid methanol. The aluminum chloride sludge is separated in these. The polymer is then treated with fresh methanol at 80 deg., neutralized with slaked lime, and filtered. The clear and neutral oil goes into a vacuum-distillation plant, in which the first polymerization runnings are separated and the correct flash point standardized. The finished oil accumulating as a column sump is now treated with 0.2 percent fuller's earth at 120 deg.

The first light oil is again subjected to polymerization while the polymer is treated thermally in a depolymerization plant with the air shut off until the viscosity has gone down from 4 to 4.5 $E_{20}$ to 3 $E_{20}$. The low-boiling dissociation products formed during depolymerization were then separated in a connecting vacuum distillation.

Experimental work conducted in the meantime showed that valuable aircraft motor oils can be prepared with almost the same excellent performance properties as the pure SS-903-oils, if a high-viscosity ethylene polymer of 6 $E_{20}$ (thus an SS-906-oil) is produced and mixed with a highly refined low-viscosity mineral lubricating oil of about 1.8 $E_{20}$; the proportion is 1:1. In this way the depolymerization as well as the vacuum distillation are discontinued. The first light oil can be separated from the crude polymer merely by atmospheric distillation if some 10 percent steam is injected in the column sump during operation.

After the plant had been switched in the fall of 1938 to production of an oil with a 6 $E_{20}$, it was expanded further to produce 3,000 tons per year. Autoclaves with a capacity of 1,000 liters were replaced by similar ones with a capacity of 4,500 liters (diameter, 800 mm.; length, 9,000 mm.). The 3,000-tons-per-year plant was started up in the fall of 1939. It reached 4,000 tons per year in 1940 and 10,000 tons in 1942. Autoclaves with a diameter of 1,000 mm. and a capacity of 11 cu.m. were then used. Construction of three more ethylene-lubricating oil plants was started in 1941: in Schkopau with a capacity of 10,000 tons per year; in Heydebreck with a capacity of 22,000 tons per year; and in Moosbierbaum with a capacity of 4,000 tons per year. The Schkopauer plant was put in operation in the fall of 1943; the other two were ready for operation in the summer of 1944, but they were so badly damaged by bombs they could not be used.

Digest from "Polymerization of Ethylene to Lubricating Oils" by H. Zorn, *Angewandte Chemie* A 60, No. 7-8, p. 185-192, 1948. (Published in Germany.)




**CATALYST TUBE FURNACES,** to operate successfully, require accurate heating with controlled variations in the heat intensity, depending upon the charging stock chemical reactions, type of catalyst and the end product desired.

With Petro-Chem design, the heat intensity may be varied at different elevations to give a wide range of accurately controlled flexibility required for catalytic reactions. Vertical tubes simplify the handling of the catalyst.

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# FACTS ON FILTERING

*Representative case histories on widely varied clarification problems condensed from field reports of Johns-Manville Filtration Engineers*



## Lens Polish Maker Saves Time Filtering Sulphuric Acid With Filter-Cel

*(reported by J-M Engineer J. H. Corbett)*

NEW YORK DISTRICT: This company produces a glass lens polish. Filtration is an important step in the process and is used for removing fine silica particles from sulphuric acid.

Before they used any filter aid, it took 10 hours to filter a 1200-gallon batch of the acid solution through a 24" x 24" plate filter. The screen quickly became clogged with silica which seriously cut down the flow rate.

Using 25 lbs. or .25% of our Filter-Cel, we reduced the cycle time to 2½ hours. This gave an increase in flow rate from .75 gal. per sq. ft. to 3 gal. per sq. ft. per hour.

By doubling the amount of filter aid, I demonstrated that the cycle time could be further reduced to two hours, but since the additional half-hour saved is not important, and they were well satisfied with the first trial, they will continue with the 25 pounds of filter aid used in the original run.

## Gets 1000 Gal. Step-Up In Soap Filtration With Hyflo Super-Cel

*(reported by J-M Eng. P. A. Martinson)*



MINNEAPOLIS DISTRICT: While making a service call on a soap manufacturer recently, I found they were having trouble filtering scrub soap.

I inspected their filter station and found that they were covering their cloths with a light paper to make for easier cleaning. During the filtering operation this paper became discolored and showed evidence of plugging. In order to keep the slime off the paper, I suggested that they precoat with Hyflo Super-Cel and also use Hyflo in the main body filtration. I also recommended that they make a change in the type of filter cloth they were using.

Previously, they had been getting 900 to 1000 gallons through per eight hour shift. On the run with Hyflo, we put 2000 gallons through in the same period. Needless to say, they were pleased with the improvement and will continue to use Hyflo.

## Helps New Filter Station Off To Good Start

*(reported by J-M Eng. W. J. Bucklee)*



PHILADELPHIA DISTRICT: One of my customers was setting up a new filter station for the reclamation of kerosene wash solvent. They called on me for help and I made a trip to their plant to help them get started.

This solvent is used by them for cleaning printing rolls, and contains not only ink and color, but some grease as well. The installation included a small 24 sq. ft. filter and a direct connected herringbone gear pump driven by a ½ H.P. motor. It has an automatic cutout at 20 lbs. pressure. The filter screens are covered with cotton cloth which we precoated with 3 lbs. of Hyflo Super-Cel by recirculation.

Examination of a sample of the solvent returning to the precoat tank showed it to have good clarity and the flow was then switched over to the clear solvent tank. I also recommended the substitution of a centrifugal pump for the gear pump so that they can take full advantage of the maximum pressures possible with their filter.

## Hyflo Makes Apple Pressing Easier

*(reported by J-M Eng. F. D. Richards)*



CINCINNATI DISTRICT: During my first call on this customer, I recommended the use of 2% Hyflo Super-Cel as a pressing aid in their apple pulper.

Recently, when I called again, they informed me of their results. Ordinarily, with the kind of apple they are using at present, the press cake is squashy and slippery. With Hyflo, the cake is much firmer and they are able to operate the press at a higher pressure. This, according to their estimate, has increased the juice yield by approximately 5%.

Although with other types of apples, no increase in yield has been noted, the addition of Hyflo does permit easier stripping of the cake, and this advantage alone is sufficient to justify its use.

## How To Get Help With Your Filtration Problems . . .



If you are not getting the desired clarity or if your filtration flow rates are too slow, here is a helpful suggestion. Just call in your nearest Johns-Manville Filtration Engineer. His experience with all types of filtration problems should enable him to locate and correct the trouble without difficulty. If your present filter aid is at fault, he can recommend a grade of Celite Filter Aid that will give you any required combination of clarity and flow rate. Just write Johns-Manville, Box 290, New York 16, N. Y., for the address of the J-M Filtration Engineer nearest you.

Johns-Manville JM
Celite Filter Aids
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# CHEMICAL ENGINEER'S BOOKSHELF

*Lester B. Pope,* ASSISTANT EDITOR

## Succint

ORGANIC REACTIONS, VOL. IV. *By Roger Adams. John Wiley & Sons, New York. 428 pages. $6.*

*Reviewed by R. L. Clarke*

THIS is the fourth volume in a series which is planned as a complete descriptive and reference work on the more important synthetic reactions of organic chemistry. The chapters are written by persons well versed in their subjects and each covers a reaction with sufficient thoroughness to obviate further literature search with few exceptions. The structure of the chapters is uniform, describing the method, modifications, examples of applicability, special precautions, details of procedure, and expected yields, and recording all known examples of the reaction with references.

Contents of Vol. IV: The Diels-Alder Reaction with Malcic Anhydride. The Diels-Alder Reaction: Ethylenic and Acetylenic Dienophiles. The Preparation of Amines by Reductive Alkylation. The Acyloins. The Synthesis of Benzoins. Synthesis of Benzoquinones by Oxidation. The Rosenmund Reduction of Acid Chlorides to Aldehydes. The Wolff-Kishner Reduction. Index.

This is a brilliantly planned and executed work. It is complete, succinct, and clear. It is invaluable both for study and laboratory application.

## Old Faithful

OUTLINE OF PHYSICAL CHEMISTRY. *By Farrington Daniels. John Wiley and Sons, New York. 713 pages. $5.*

*Reviewed by Kenneth A. Kobe*

SINCE 1913 when Dr. F. H. Getman wrote "Outlines of Theoretical Chemistry," a new edition has appeared at five year intervals, with the coauthorship of Dr. Daniels beginning in 1931. The present book is under the sole authorship of Dr. Daniels and should be regarded as a new book rather than a revision of previous editions.

Some of the noteworthy changes are the replacement of idealized diagrams by experimental diagrams showing data points and usually giving reference to the recent journal publication; elimination of some elementary material and its replacement by recent advances in physical chemistry; literature references to important journal articles and particularly elementary review articles as in the *Journal of Chemical Education;* and, an appendix containing some of the more advanced derivations.

Dr. Daniels' reputation in the fields of thermodynamics, kinetics and nuclear research is well known and the book would be expected to be particularly strong in these fields. The book opens with a discussion of the gaseous state and presents the Hougen and Watson generalized compressibility chart. Although Daniels briefly discusses compressibility and defines it as $pV/RT$, he does not use the common abbreviation z for this function. The next three chapters discuss atomic and molecular forces, the crystalline state and the relationships between molecular structure and physical properties. Thermochemistry and thermodynamics occupy the next three chapters. Again, it would be convenient to the student to use one set of nomenclature and symbols. Why retain $E$ when the engineers have standardized on $U$. $F$ instead of $G$, and others?

The chapter on the liquid state is naturally followed by two chapters on solutions. An excellent elementary discussion of fractional distillation of binary solutions is given. The heart of the book is in the next three chapters (140 p.) on chemical equilibrium, phase diagrams and chemical kinetics. In the latter, the section on mathematical analysis of complex reactions is noteworthy. The following three chapters on theoretical electrochemistry of ionic solutions are followed by chapters on colloids, quantum theory, photochemistry, and finally atomic and nuclear structure in which is a drawing of the first nuclear chain-reacting pile.

Many chemical engineers have a copy of an older edition, used as a text during their student days, reposing on their reference shelves. Now is a good time to replace the old one with the latest model.

### RECENT BOOKS RECEIVED

**Engineering the New Age.** By J. J. O'Neill. Ives Washburn. $3.50.

**The Failure of Technology.** By F. G. Juenger. Henry Regnery. $2.75.

**Handbook of Plastics. 2nd ed.** By H. R. Simonds, A. J. Weith & M. H. Bigelow. Van Nostrand. $25.

**Scientific Foundations of Vacumm Technique.** By S. Dushman. Wiley. $15.

**Silicones and Other Organic Silicon Compounds.** By H. W. Post. Reinhold. $5.

**Standard Handbook for Electrical Engineers.** 8th ed. by A. E. Knowlton. McGraw-Hill. $12.

**The Structure of Matter.** By F. O. Rice & E. Teller. Wiley. $5.

## Stimulating Biography

MENDELEYEV: THE STORY OF A GREAT SCIENTIST. *By Daniel Q. Posin. Whittlesey House, McGraw-Hill Book Co., New York. 345 pages. $4.50.*

*Reviewed by H. C. Parmelee*

PROBABLY every beginning student of chemistry for the past two generations has had his curiosity aroused by a strange chart hanging on the classroom wall, entitled "Periodic System of the Elements." And although he learned later to associate the chart with the name of Mendeleyev, it could give only a faint clue to the genius of the great Russian scientist who made this classical contribution to chemical knowledge. Nothing short of a full length biography, such as Dr. Posin has so entertainingly written, could properly appraise Mendeleyev's stature as a scientist or his service to his native land.

The rise of Mendeleyev from boyhood in an obscure Siberian village to international fame in scientific circles is a fascinating story. It is at once a tribute to his mother's courage and determination to educate him, and his own passion for knowledge through which he could enlighten and benefit his native Russia. Denied admission to the University of Moscow, he later enrolled at St. Petersburg where he remained as student and professor until he resigned in protest against the unwillingness of the authorities to grant the students a larger measure of freedom. As a "peaceful evolution-

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look to LEE Kettles

FOR CORROSION-RESISTANT EQUIPMENT

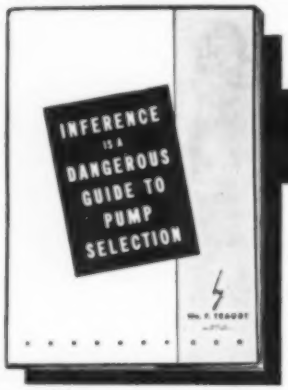


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Fault-filled enthusiasms for certain types of pumps now running rampant in industry, are dangerous. Because a *type* of pump performs sensationally on somebody else's job, it isn't necessarily certified to your use.

The unbiased, basic facts concerning types of pumps are contained in our special bulletin S-416. Big illustrations and briefed descriptions deal with the capacities and adaptability of such types as piston, plunger, rotary and centrifugal pumps. We'll gladly send a copy free, if you will request it on your company letterhead.

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TABER PUMPS for Higher Practical Performance

ist" in a land marked by tyranny and ignorance, he could do no less.

The wide range of his interests was amazing. He wrote with authority not only on chemistry and physics, but also on agriculture, and industry, meteorology and mineralogy. He investigated spiritualist phenomena, aided in establishing standard weights and measures, and told his government how to raise the standard of living by increased production. On the occasion of a total eclipse of the sun he made a balloon ascension alone to a height of nearly 12,000 feet, drifting 150 miles from his starting point, recording his observations as he flew. He was a prodigious worker, as evidenced by frequent contributions to scientific journals, organization of scientific societies, publication of "Principles of Chemistry" and other volumes, and industrial investigations at the request of the government. He studied the petroleum industry in the United States, laid the groundwork for the development of the Baku oil fields, the Donetz coal deposits, and the Ural iron ores. Yet there was never enough time to do all the things that needed doing, nor was any sacrifice too great. On several occasions he had to leave the rigorous climate of St. Petersburg to recuperate from pulmonary troubles, and near the end of his life he underwent an operation to restore his eyesight.

Mendeleyev's great work on the periodicity of the elements was marked by interminable laboratory research, correspondence with other scientists, checking and rechecking his own results and those of others. He boldly assigned new atomic weights to elements in order to fit them into his periodic table, predicted the discovery and properties of new elements that would fill the blank spaces, and lived to see his contentions vindicated. The work brought international acclaim, with award of the Davy and Copley medals, honorary degrees from Edinburgh, Göttingen, Oxford, and Cambridge, and numerous lesser honors. In his own country he gained the homage and respect of all, from peasant to Tsar.

In his private life Mendeleyev was simple and democratic. His clothing was rough, and his shaggy hair and beard grew almost untrimmed. His scorn of pomp and ceremony was such that he refused to "dress up" for appearance at a court function to which he was bidden by the Tsar. But he complimented his fellow scientists by appearing in formal attire to receive their honors.

Twice married, his first matrimonial venture was a disappointment and resulted in divorce; the second was happy and successful by every stand-




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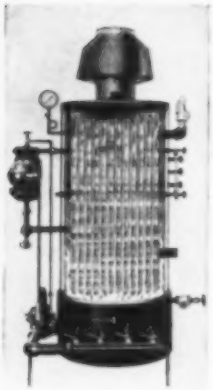


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and. His death at the age of 73 was a cause for national mourning, and the funeral was attended by multitudes of Russians of high and low estate. His biography will be read with profit and satisfaction by scientist and layman alike.

## Section One

CRYSTAL STRUCTURES. *By Ralph W. G. Wyckoff. Interscience Publishers, New York. $8.*

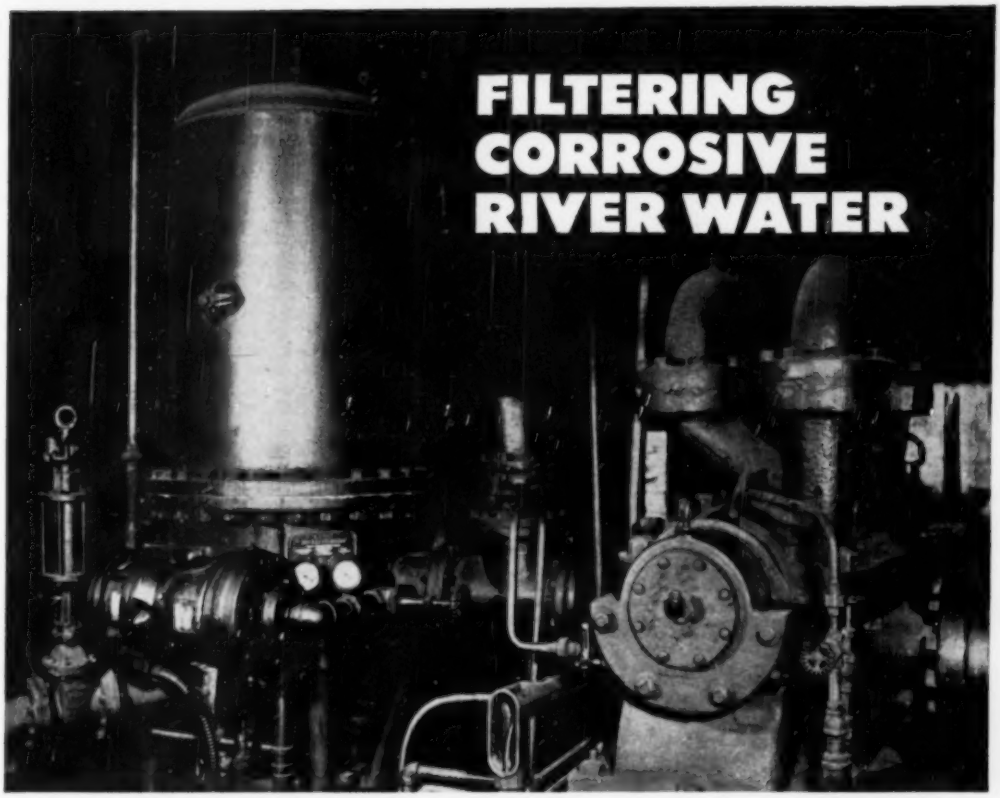
*Reviewed by Joseph S. Lukesh*

SCIENTISTS and engineers concerned with solid materials are becoming increasingly aware of the importance that crystal structure plays in determining the nature of and variations in the physical and chemical properties. They will, therefore, welcome this volume as a useful addition to their reference library.

In format, the book represents an experiment. Only the first of three sections is published at this time, and in order to allow for inclusion of the remaining two as well as future supplements, a loose-leaf binding was adopted. This will eliminate the necessity of examining every individual volume, as in the case of the *Strukturbericht*, and permit the work to be kept up to date as supplements are issued. Each chapter is divided into four sections: text, tables, illustrations, and bibliography. To facilitate inclusion of future data, pages of each section are numbered independently. It is unfortunate that, in the case of the illustration sections where numerous figures have been temporarily omitted for expediency, pages were numbered consecutively. One finds, for instance on the page labelled "Chapt. IV, illus. page 9" Fig. IV 12 and on the following p. 10, Fig. 15. Since there is only one illustration per page, a more logical numbering system could have been adopted.

The text of this first section of "Crystal Structures" covers, in separate chapters, elements, and compounds of the types RX, $RX_2$, $R_mX_n$, $R(MX_2)_n$, and $R_n(MX_3)_p$. Future sections will include more complicated formulas as well as hydrates, silicates and organic compounds. A description of structural types for each composition serves as an introduction to each chapter. This is followed by a tabulation of all chemical compounds whose structures have been described giving such pertinent data as composition, lattice constants, parameters and interatomic distances. The third section contains illustrations of the various structural types. Each illustration contains two figures: the conventional schematic array of atomic positions, and a packing drawing showing the atoms constructed to scale,

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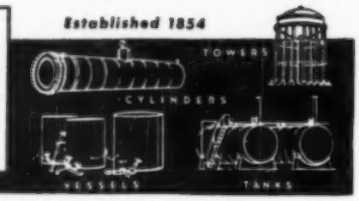



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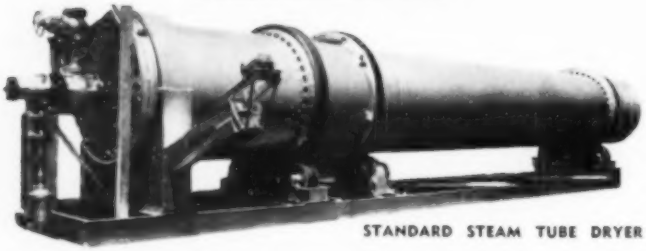
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using their effective radii. This latter feature should prove of great value. The very extensive bibliography which concludes each chapter is also worthy of particular note. Since structure determinations are often controversial, accurate references to the original data are invaluable.

In summary, it may be said that this book belongs on the shelves of every technical library. It is to be hoped that the author and publishers will make every effort to keep the work up to date with frequent supplements.

## British Science at War

SCIENCE AT WAR. *By J. G. Crowther and R. Whiddington. Philosophical Library, New York. 185 pages. $6.*

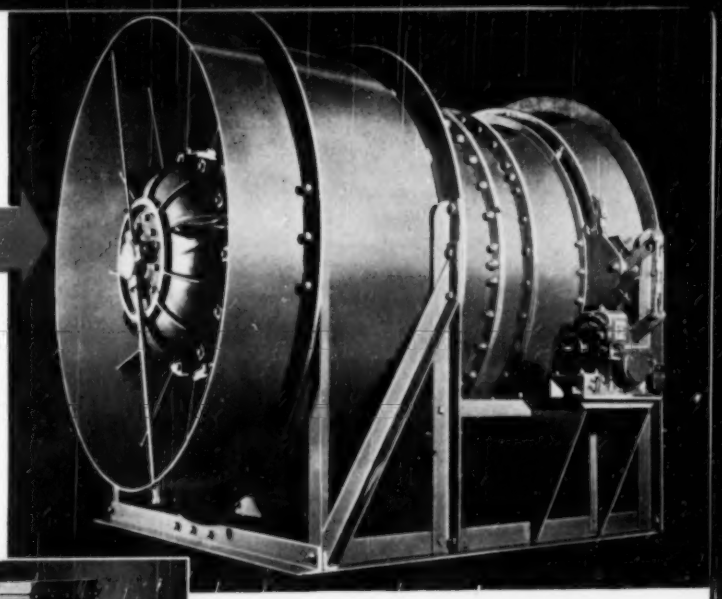
*Reviewed by H. C. Parmelee*

OFFICIALLY sponsored by the Scientific Advisory Committee to the Cabinet, this volume records the vital service rendered by British scientists to the armed forces of their country during the late war. In purpose and content it is similar to several volumes on the mobilization for war of American scientists; but it brings into sharp relief the desperate plight of an island nation that was an enemy target, and the brilliant contribution of its scientists to the ultimate victory. Obviously, the whole story cannot be told within the compass of a small volume, so the authors have confined their attention to four topics: radar, operational research, the atomic bomb, and science and the sea.

The geographical location of England made radar a prime means of defense. The scientific basis of radiolocation by echo of radio waves had been established before the war, and peacetime experiments were undertaken to detect the presence of aircraft off the east coast. By 1935 a station had been established that was effective at 40 miles for the detection planes flying at 15,000 ft. By 1939 a chain of stations had been extended to protect the entire east coast. Detection of low-flying craft (500 ft.) was added by 1940, and in September 1941 the entire island had radar cover against high- and low-flying planes, effective for more than 100 miles. With the steady improvement of radar equipment it was soon adapted to offensive as well as defensive warfare, particularly in blind navigation, night bombing, anti-submarine operations, and range-finding at sea.

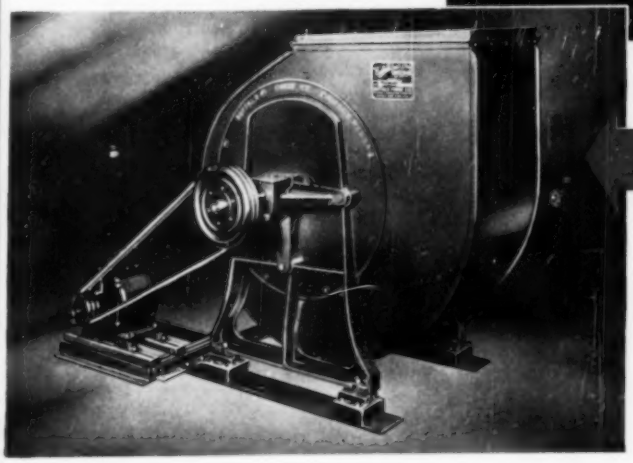
Operational research—the application of statistical analysis to the use of weapons and the conduct of military and naval operations—called for the closest cooperation of scientists and leaders of the armed forces. Varied problems were tackled and solved: the

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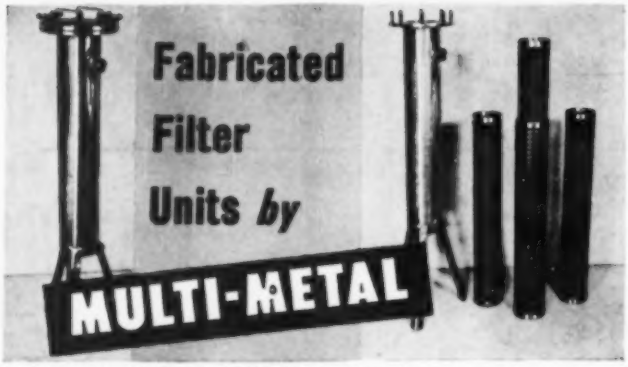

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best setting for the explosion of depth charges; optimum size of convoys; most efficient use of air escort; causes of bomber loss; shooting from tanks at moving objects; and mine laying. In these and many other matters, operational research afforded the finest examples of collaboration between civilian scientists and military leaders.

Because the atomic bomb was finally produced in the United States, the uninformed might easily overlook the vital contributions to its development by English and European scientists. The decision to make the bomb here was determined in large degree by adequate manpower and industrial facilities in the United States, both of which were obviously short in England. So this chapter serves the admirable purpose of paying tribute to the genius of Rutherford, Soddy, Einstein, Bohr, Fermi, Meitner, and many others whose scientific work paved the way for atomic explosions. The final result was an achievement in international cooperation.

Problems of offensive and defensive warfare at sea naturally received attention from Britain's best scientific minds. Methods for the detection of submarines were greatly improved, and U-boat destruction was increased until that means of warfare was no longer a major menace. Successful measures were introduced to avert danger from magnetic and acoustic mines, and foil the enemy's use of the acoustic homing torpedo.

Laymen who are interested in science will derive considerable satisfaction from reading this book, particularly the chapters on radar and the atomic bomb. Both give a clear exposition of the scientific basis of their subjects, and the history of their development.

## Goblin Metal

COBALT. *By Roland S. Young. Reinhold Publishing Corp., New York. 181 pages. $5.*

THIS is a sound little book: it is comprehensive but not academic, practical yet backed up by just the right amount of theory. It does a good job in digesting the scattered and none-too-voluminous literature; yet it contains considerable information that had never been published—information based on personal experience in the industry and on close contact with others in the field. It is, by the way, one of only two recent comprehensive books on the subject; the other is Perrault's *Le Cobalt* (1946).

The subject, naturally, is considerably more interesting to the metallurgical than to the chemical engineer. But the range of topics is wide: his-






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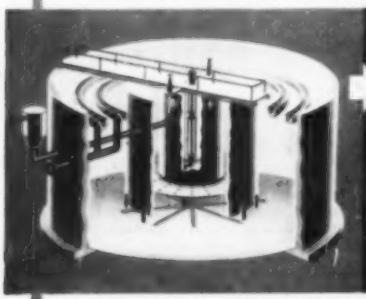
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### Reliably Comprehensive

PRACTICAL SPECTROSCOPY. *By G. R. Harrison, R. C. Lork and J. R. Loofbourow. Prentice-Hall, New York. 605 pages. $6.65.*

*Reviewed by Edwin K. Jaycox*

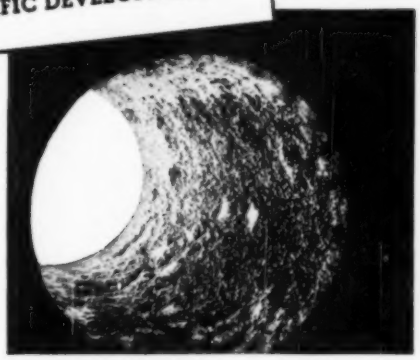
"PRACTICAL SPECTROSCOPY," by Harrison, Lork and Loofbourow, is both an excellent text and reference book comprehensively covering the entire field of spectroscopy. The purpose of the book, as stated by the authors, is ". . . to help the worker in any branch of science to evaluate the aid which techniques of spectroscopy might lend to the solution of his own problems." In this they have been eminently successful. The authors are, respectively, a physicist, a chemist and a biophysicist and the points of view of these branches of science have been ably blended together.

The first chapter views the field as from a great height dealing with the divisions of the field, general techniques applicable in each division, and the many uses in industry and research of spectroscopy. The next 12 chapters deal with the theory of spectra, both atomic and molecular; radiation sources from the far infrared to the extreme vacuum ultraviolet; and instrumentation in all the branches, including descriptions, testing, care and adjustment of all types of spectrographs as well as the auxiliary equipment needed in each special field. The remaining chapters cover the applications of spectroscopy in the fields of emission qualitative and quantitative analysis, absorption in the infrared, visible and ultraviolet, Raman spectra, interferometric spectra and the vacuum ultraviolet region. No branch of spectroscopy has been overlooked.

Although the authors have chosen comprehensive rather than exhaustive coverage of their subject, they have, nevertheless, considered the various topics in appreciable detail and included specific references to the literature to enable the reader to delve deeper into the subjects which may concern him. Actually, most topics have been treated in sufficient detail to provide the student and the worker in some branches of spectroscopy with

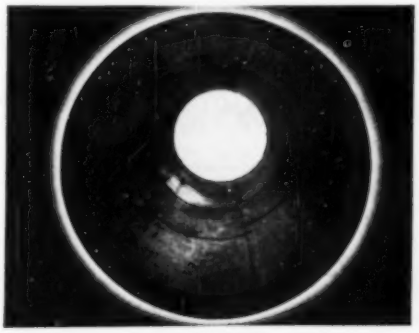
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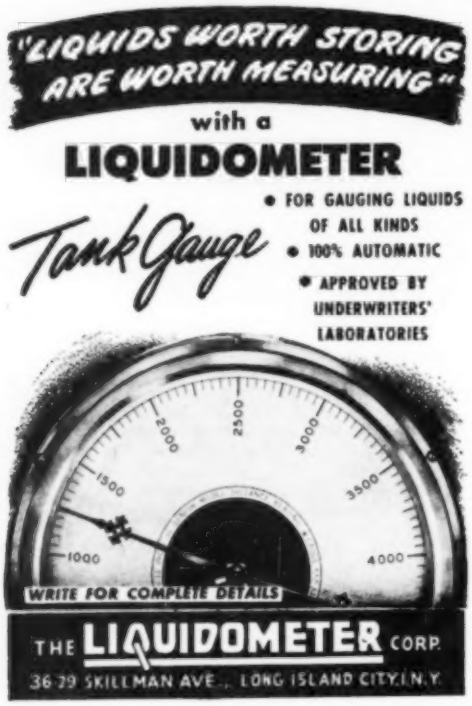
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all the information he is likely to need. This is particularly true of those parts of the book dealing with fundamental background and instrumentation. The treatment of those parts dealing with specific applications is of necessity not extensive. Illustrative examples are given and the way paved for the reader to follow through by means of numerous references to appropriate literature. A very excellent balance between comprehensive and exhaustive coverage has been maintained, which imparts to the book its maximum worth both as a text and reference book.

The material contained in the book is up to date and has been presented in a clear straight forward manner that students and workers in the field can readily understand. Those outside of the immediate field of spectroscopy, such as chemical engineers, chemists, physicists, and biologists, will find the book profitable reading, particularly those parts dealing with the applications of spectroscopy, for the many valuable leads to be found regarding the solution of various analytical problems by means of the spectroscopic approach. The authors have not relied alone upon their own extensive knowledge and experience but before publication, consulted with many of the outstanding spectroscopists in the country who read and criticized those chapters dealing with the field of their own specialty. The result is a book containing thoroughly reliable information on spectroscopy.

This book should certainly be on the shelf of every university and technical organization library as well as in the laboratory of every worker in the field.

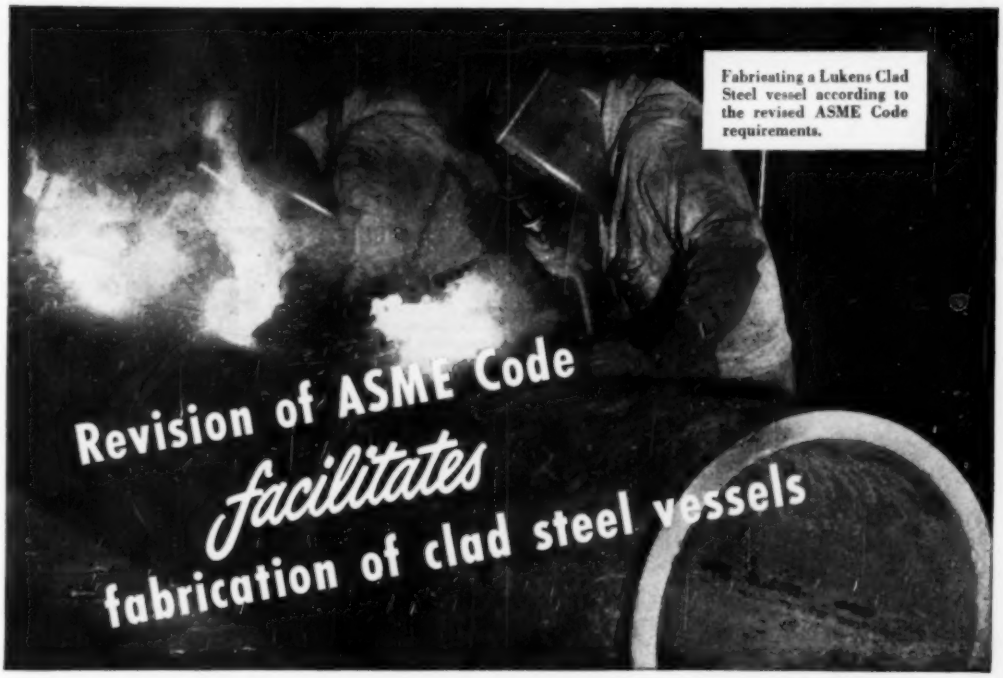
## Textile

THE CHEMICAL TECHNOLOGY OF DYEING AND PRINTING. SECOND EDITION. *By Louis Diserens. Translated and revised by Paul Wengrof and Herman Baumann. Reinhold Publishing Corp., New York. 500 pages. $11.*

*Reviewed by Thomas J. Tully*

THIS book is an excellent English translation of the treatise by the French dyeing authority Louis Diserens. Dr. Diserens is noted as a skilled chemist-colorist having worked in printing and dyeing plants of pre-war Russia as well as in one of the leading Alsatian print works which produces textile fabrics for the world wide trade.

The translation was made from the second German edition published in 1946. Many references not accessible to European readers have been added while some of the facts, less important from an industrial viewpoint, have




As announced recently in Mechanical Engineering, Case 896 of the ASME Code has been further revised. Rulings cover welding procedure and operator qualification requirements, with the result that, in many cases, the fabrication of clad steel equipment is facilitated and speeded up.

All-alloy welds can be used throughout the entire section of a clad steel shell where the small diameter, for example, makes this necessary. Materials meeting Specification SA-263, Grade A (Type 410) can be used without stress relief if the carbon content of the cladding is less than 0.08. Temperature limitations for certain types of clad metals have been modified.

Case 1078, covering the use of linings which are applicable to certain fittings—manways, nozzles and the like—is also now available for the first time.

For general information on Lukens Nickel-Clad, Stainless-Clad, Inconel-Clad and Monel-Clad Steels, write for Bulletins 255 and 338. Lukens Steel Company, 400 Lukens Building, Coatesville, Pennsylvania.

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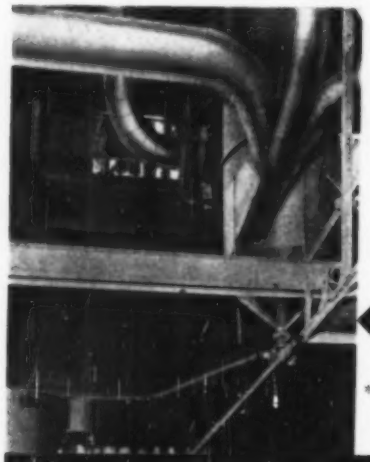
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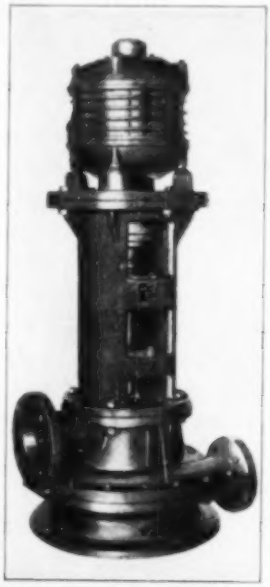


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been abridged. Some data regarding new nylon fiber developments have also been added.

The book is divided into five sections comprising vat dyestuffs, sulphur dyestuffs, the indigisols, the insoluble azo dyestuffs and the mordant dyestuffs. The historical development of each class is given in some detail but little or no detailed manufacturing data are included. However, the chemical treatment of the various dyestuffs is good and the book is replete with structural formulas.

As is indicated by the title, the main body of the text is devoted to the science and art of dyeing and printing. Detailed descriptions of dyeing and printing processes are given and numerous references to the original literature are included. In addition to a discussion of the dyestuffs proper there is a comprehensive coverage of dyeing and printing auxiliaries including several excellent tables.

This informative volume should be a welcome addition to the libraries of textile printing and processing plants and research laboratories and will be of especial interest to organic chemists, colorists and others interested in the technical aspects of dyes and colors.

## RECENT BOOKS and PAMPHLETS

**1949 Directory of Occupational Safety Posters.** Published by National Safety Council, 20 North Wacker Dr., Chicago. 72 pages. 50 cents. Contains illustrations of two, three and four color posters, classified under 15 sections.

**American Standard Letter Symbols for Physics, Z10. 6-1948.** Published by American Standards Association, 40 East 45th St., New York. $1. All common terms in elementary physics and some advanced physics and related fields are included.

**Symposium on Spectroscopic Light Sources.** Special Technical Publication No. 76, published by American Society for Testing Materials, 1916 Race St., Philadelphia. 79 pages. $2. Four formal papers in addition to discussions, presented at the 1946 annual meeting of ASTM.

**Notes on Soldering.** By W. R. Lewis. Published by Tin Research Institute, Battelle Memorial Institute, 505 King Ave., Columbus, Ohio. 88 pages. Gratis. Advances in soldering technique likely to be of value to solder-users in a large variety of industries.

**The First Hundred Years of the New Jersey Zinc Company.** Published by New Jersey Zinc Co., 160 Front St., New York. 76 pages. The story of the part this company has played in the zinc industry in America.

**The Story of Magnesium.** By W. H. Gross. Published by American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. 260 pages. $1.50. Written for the non-professional to provide technical information needed to understand the science of magnesium as it is applied in industrial production.

**Small-Scale Production of Portland Cement.** By K. O. Beatty, Jr. and R. B. Adair. Bulletin No. 42, published by Department of Engineering Research, North Carolina State College, Raleigh, N. C. 51 pages. 35 cents. Second report on an investigation of the possibility of using native North Carolina raw materi-

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als for the manufacture of portland cement.

**Industrial Health Department Functions and Relationships.** By C. O. Sappington. Medical Series: Bulletin No. VIII, published by Industrial Hygiene Foundation, 4400 Fifth Ave., Pittsburgh, Pa. 98 pages. $2. A two-year cross-sectional survey of industry's health facilities, embracing 277 plants in 33 states.

**Glass Glossary.** Published by American Ceramic Society, 2525 North High St., Columbus, Ohio. 11 pages. Commonly accepted usages.

**Proceedings of the First Annual Management Engineering Conference.** By Donald K. Andrews. Bulletin No. 106, published Texas Engineering Experiment Station, College Station, Tex.

**The Measurement of Stress and Strain in Solids.** Physics in Industry Series, published by Institute of Physics, 47, Belgrave Sq., London, S.W. 1, England. 114 pages. $4. Eleven papers and summaries of discussions on them presented at a conference of this institute in July 1946.

**Hydrofluoric Acid (Aqueous & Anhydrous).** Manual Sheet H-10, published by Manufacturing Chemists' Association, 246 Woodward Bldg., Washington 5, D. C. 22 pages. 25 cents. Handling and discharge of containers.

**Directory of Manufacturers in Tulsa.** Published by the Industrial Department, Tulsa Chamber of Commerce. $2. Classifies manufacturers by (1) name of manufacturer, (2) type of product manufactured. Indicates the number of employees in each company.

**A.S.T.M. Standards on Plastics.** Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 595 pages. $4.50. Specifications, methods of testing, nomenclature, definitions.

**Tentative Standard on Pipe Friction.** Published by Hydraulic Institute, 50 West St., New York, N. Y. $1.50. In each table, the flow in gpm. and cfs. are shown with the corresponding velocity, velocity head, and friction loss per 100 ft. of pipe.

**Phosphoric Anhydride.** Chemical Safety Data Sheet SD-28 published by the Manufacturing Chemists' Association, 246 Woodward Building, Washington, D. C. 12 pages. 20 cents. Safe handling and use.

**Forming of Austenitic Chromium-Nickel Stainless Steels.** By V. N. Krivobok. Published by the International Nickel Co., 67 Wall St., New York. $1. Describes the modern forming procedures applied to chromium-nickel stainless steels as practiced in the fabrication plants of the United States.

**Gas Facts.** Published by American Gas Association, 420 Lexington Ave., New York 17, N. Y. 195 pages. $1. A statistical record of the gas utility industry in the United States, 1947.

**Chemical Industries.** Twenty-first edition. Published by Leonard Hill Ltd., 17, Stratford Place, W. 1., London, England. 405 pages. £1. A reference book and buyer's guide covering the principal branches of the chemical industry in England.

**Technical Association Papers.** Edited by R. G. Macdonald and Richard T. Bingham. Series 31—1948, published by Technical Association of the Pulp and Paper Industries, 122 East 42nd St., New York. 822 pages. $10. Annual convention papers and proceedings of the association. A record of technical development in the pulp and paper industries for 1947-48.

**The Management Guide.** By George L. Hall. Published by Standard Oil Co. of California, San Francisco. 74 pages. Organization of business from the management point of view. Some topics covered are the need and use of job description forms, the delegation of responsibility and authority, pointers on how to prepare management guides, and their proper use.

**Nederlandse Chemische en Pharmaceutische Producten.** Published by Bedrijfsgroep Chemische Industrie, 's-Gravenhage, Nederland. 296 pages. Lists

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**Symposium on Usefulness and Limitations of Samples.** Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 39 pages. $1. Three papers and discussion presented at the 1948 annual meeting of ASTM.

**A.S.T.M. Standards on Paper and Paper Products (With Related Information).** Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 286 pages. $2.50. Specifications and methods of testing.

**Design for Welding.** By Robert S. Green. Published by James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio. 1,024 pages. $2. Contains 82 papers discussing various representative welded designs.

**Werkstoff-Tabelle, 1948.** By Erich Rabald. Published by Dechema, Frankfurt am Main, Germany. 134 pages. The first postwar edition of these famous tables.

## GOVERNMENT PUBLICATIONS

*The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. When no price is indicated, the pamphlet is free and should be ordered from the Bureau responsible for its issue.*

**Statistics on the Uses of Specially Denatured Alcohol, Fiscal Year Ended June 30, 1948.** Alcohol Tax Unit unnumbered press release of Jan. 17, 1949. Mimeographed.

**List of Publications on Chemistry of Wood and Derived Products.** Forest Products Laboratory. No. R238 revised to November 1948. Available only from Forest Products Laboratory, Madison 5, Wis. A bibliography.

**Microbiological Deterioration of Organic Materials.** National Bureau of Standards. By E. Abrams. Miscellaneous Publication 488. Price 25 cents. Reviews causes, methods of testing, and prevention for leather, rubber, plastics, cellulose materials, and protein products.

**Coarse Aggregates.** National Bureau of Standards. Simplified Practice Recommendation R163-48 (supersedes R163-39). A recommended specification especially for size classification of crushed stone, gravel and slag. Price 10 cents.

**Table and Mollier Chart for Ammonia Below −60° F.** By C. H. Meyers. National Bureau of Standards, Circular 472. Price 10 cents.

**Optical Glass at the National Bureau of Standards.** By F. W. Glaze and C. H. Hahner. National Bureau of Standards, Circular 469. Price 15 cents. A description of the facilities and methods used by the Bureau in small scale manufacture.

**Precision Resistors and Their Measurement.** National Bureau of Standards, Circular 470. Price 20 cents. Deals with materials and construction methods, methods of comparison of resistors, special apparatus for precision measurements, calibration of precision bridges, and resistivity of solid conductors.

**Fire Resistance of Structural Clay Tile Partitions.** By Harry D. Foster, et al. National Bureau of Standards, Building Materials and Structures Report BMS-113. Price 15 cents. One of a series


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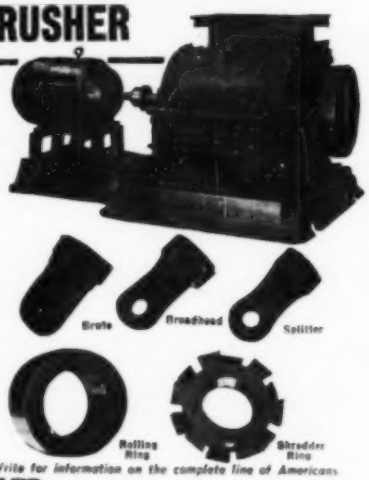
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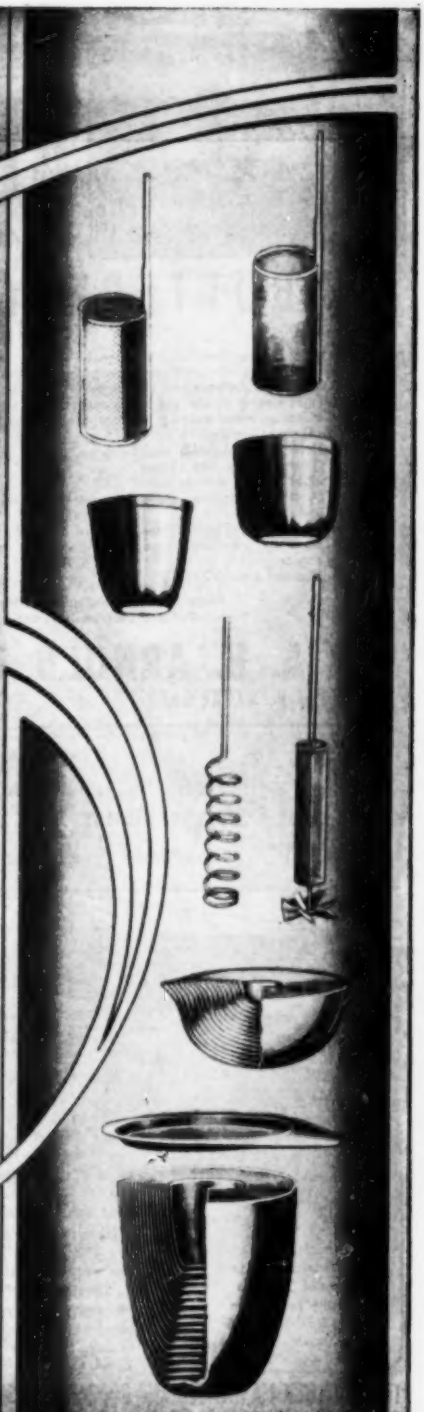
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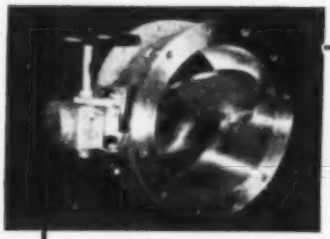
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**Mineral Wool Insulation for Low Temperatures.** National Bureau of Standards. Commercial standard, CS195-48 (supersedes CS195-42). Price 10 cents. Approved commercial standard for mineral wool insulation for low temperature.

**Method for Spectrochemical Determination of Silver in Ore Samples.** By G. W. Marks and E. V. Potter. Bureau of Mines Report of Investigations R. I. 4377. Mimeographed.

**National Motor-Gasoline Survey, Summer 1948.** By O. C. Blade. Bureau of Mines Report of Investigations R. I. 4444. Mimeographed.

**Central Kansas Clay Deposits.** By W. D. McMillan and A. O. Wilson. Bureau of Mines Report of Investigations R. I. 4379. Mimeographed.

**Concentration of Fluorite From Tailings and Mine Waste Rock in Crittenden and Livingston Counties, Ky.** By M. M. Fine. Bureau of Mines Report of Investigations R. I. 4370. Mimeographed.

**Flake-Graphite and Vanadium Investigation in Clay, Coosa, and Chilton Counties, Ala.** By H. D. Pallister and J. R. Thoenen. Bureau of Mines Report of Investigations R. I. 4366. Mimeographed.

**Investigation of the Four Chromes and Other Chromite Deposits, Red Lodge District, Carbon County, Mont.** By J. A. Herdlick. Bureau of Mines Report of Investigations R. I. 4369. Mimeographed.

**Improvements in Hydrogenation of Coal.** By L. L. Hirst, L. C. Skinner, and E. E. Donath. Bureau of Mines Information Circular I. C. 7488. Mimeographed.

**Methods of Producing Ultra-Clean Coal for Electrode Carbon in Germany.** By H. G. Graham and L. D. Schmidt. Bureau of Mines Information Circular I. C. 7481. Mimeographed.

**Report of Petroleum and Natural-Gas Division, Fiscal Year 1947.** By R. A. Cattell and Others. Bureau of Mines. Information Circular I. C. 7484. Mimeographed.

**Measure of Safety Injury Frequency Rates.** Bureau of Labor Standards, Bulletin No. 102. Price 5 cents.

**Soybeans in American Farming.** By E. G. Strand. Bureau of Agricultural Economics. Technical Bulletin No. 966. Price 20 cents. An economic interpretation in relation to production but useful for processers and users of soy products.

**Index to River Surveys.** By B. E. Jones and R. O. Helland. U. S. Geological Survey, Water-Supply Paper 995. Price 75 cents. A resume of USGS for other agencies field studies revised to July 1947.

**Optical Calcite Deposits of the Republic of Mexico.** By C. Fries, Jr. U. S. Geological Survey. Bulletin 954-D. Price 20 cents.

**Copper in Japan.** By J. J. Collins. Bureau of Mines. Special Supplement No. 26 to Mineral Trade Notes. Mimeographed.

**The New Insecticides for Controlling External Parasites of Livestock.** Bureau of Entomology and Plant Quarantine. E-762. Mimeographed.

**Service Tests on Posts as a Means of Evaluating Wood Preservatives and Methods of Treatment.** By J. Oscar Blew, Jr. Forest Products Laboratory, No. R1726. Available only from Forest Products Laboratory, Madison 5, Wis. Suggestions as to procedure that should be used in order to obtain the maximum benefits from service tests on treated posts.

**Bleaching Wood.** By Leslie E. Downs. Forest Products Laboratory, No. R1765. Available only from Forest Products Laboratory, Madison 5, Wis. Describes methods and types of bleaching wood with chemicals.



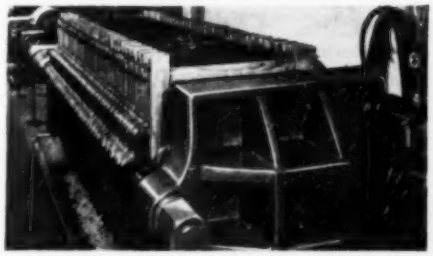
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# MANUFACTURERS' LATEST PUBLICATIONS

*Chemical Engineering's Reader's Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins, and other publications herein listed without obligation (unless a price is specifically mentioned). For your convenience, publications may be obtained by using Reader Service Coupons on pp. 167-168.*

(*Continued from page 168*)

drying, baking or heating materials. These units have no glass and the heating element is sheathed in metal. Dimensions, heating capacity, and prices are given.

**112. Conveyors.** Island Equipment Corp., Long Island City, N. Y.—4-page Bulletin No. IP-1 describes the standard belt conveyor tables produced by this company. Made of corrosion resisting steel, standard sizes have lengths which are multiples of 10 ft. and widths from 6 to 36 in. These conveyors are complete with their own power unit. They can be operated at speeds from 5 to 105 ft. per min.

**113. Instruments.** Leeds & Northrup Co., Philadelphia, Pa.—24-page Catalog ND-4B describes the method of operation and construction of the pneumatic temperature controllers produced by this company. These instruments are both indicating and recording and are equipped with extra features to obtain the best possible control, with maximum avoidance of drift and weaving.

**114. Process Equipment.** Chain Belt Co., Milwaukee, Wis.—36-page Bulletin No. 48-41 describes the various types of equipment produced by this company for separating liquids and solids. Included are sludge removers, thickeners, water screens, and clarifiers. Descriptions and line drawings of these units are included and potential applications are indicated.

**115. Process Equipment.** Pacific Coast Engineering Co., Alameda, Calif.—18-page Bulletin No. PC-50 describes the various types of equipment produced by this company. Of interest to the chemical industry are heat exchangers, tanks, pressure vessels, distillation columns, mixers and dryers.

**116. High Pressure Valves.** Hydropress, Inc., New York, N. Y.—4-page folder No. OL-43 describes the control valves produced by this company for high pressure, water-hydraulic systems. Included are control valves, prefilling valves, stop valves, check valves, bypass valves and shutoff valves.

**117. Oil-Gas Burner.** Hauck Manufacturing Co., Brooklyn, N. Y.—8-page catalog No. 405 describes the combination oil and gas burners produced by this company. Complete specifications, capacities and dimensions are shown. The burner can automatically be switched from one fuel to another without shutting down the furnace.

**118. Heating System.** J. O. Ross Engineering Corp., New York, N. Y.—16-page Bulletin No. 300 describes the hot water heating system engineered and produced by this company. Outstanding advantages and potential applications of this system are described. Actual applications are listed, varying from 3 to 93 million Btu. per hr.

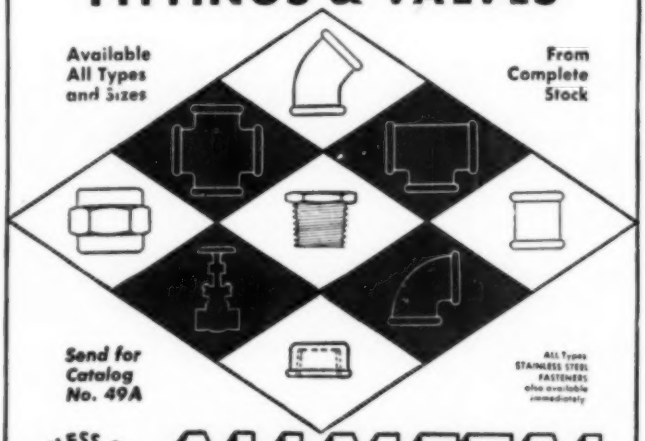
**119. Fan-Cooled Motors.** Allis-Chalmers Mfg. Co., Milwaukee, Wis.—4-page bulletin No. 0527150 describes the line of totally-enclosed fan-cooled motors produced by this company which have tube-type air-to-air heat exchangers. This line of motors runs from 150 hp. to several thousand horsepower and with


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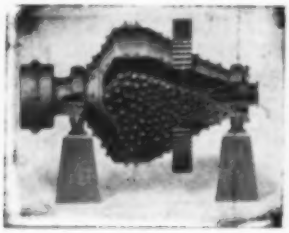
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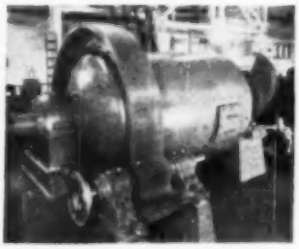
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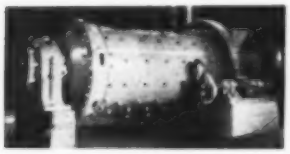
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speeds from 300 to 3,600 rpm. The motors are available in squirrel-cage, wound rotor and synchronous types.

**120. Relief Valves.** Marine & Industrial Products Co., Philadelphia, Pa.—24-page Catalog No. 80 describes the line of relief valves produced by this company for both vapor and liquid service. Specifications are given for these valves which range up to maximum service pressures of 3,000 psig. and a maximum temperature of 750 deg. F. Sizes are available from ½ in. to 6 in.

**121. Pneumatic Conveyors.** Convair Corp., Pittsburgh, Pa.—8-page Bulletin No. 102 describes the specifications and applications for the pneumatic conveying system produced by this company. Examples are shown for the unloading of ships and also for the loading and unloading of special tank cars which this company produces for the movement of powdered or granular material by rail. The latter tank cars are available in sizes up to 2,600 cu. ft. or 75 tons capacity.

**122. Insulation Tester.** James G. Biddle Co., Philadelphia, Pa.—24-page Bulletin No. 21-20-61 describes the line of insulation testers produced by this company for testing the condition of insulation. The tester may be used in the field as well as in the laboratory. Ratings and prices of these instruments are given.

**123. Heat Reclaimers.** Patterson-Kelley Co., East Stroudsburg, Pa.—12-page Bulletin describes the pit-type, closed type, tubular heat reclaimer produced by this company. They are primarily of use in reclaiming heat from hot waste liquids.

**124. Pumps.** J. S. Coffin, Jr. Co., Englewood, N. J.—4-page Bulletin S describes two types of high speed, single stage turbo pumps produced by this company for applications involving high pressure pumping. These pumps are available in capacities up to 500 gpm. and discharge pressures up to 1,100 psi.

**125. Induction Heaters.** Electric Arc Co., Newark, N. J.—Catalog sheet gives a complete listing of the induction heaters and control instruments manufactured by this company for preheating metals before welding and stress relieving after welding.

**126. Conveyors.** Rapids-Standard Co., Grand Rapids, Mich.—8-page Catalog No. RWC-48 describes the line of aluminum gravity wheel conveyors produced by this company. Standard sizes are given for straight and curved sections and for the various accessories such as switches and spurs.

**127. Valves.** Ross Operating Valve Co., Detroit, Mich.—12-page Bulletin No. 311 describes the various types of remote operated valves produced by this company. The large valves are solenoid air-pilot operated and the small valves are direct solenoid operated.

**128. Instruments.** Bristol Co., Waterbury, Conn.—56-page Bulletin No. P1238 gives detailed information on the thermocouples and pyrometers and their accessories produced by this company. The bulletin contains a technical section giving engineering data on the use of these instruments.

**129. Cooling Towers.** Marley Co., Kansas City, Kan.—Two new 4-page bulletins give information on the correct water distribution and air movements in the operation of cooling towers.

**130. Hydrocarbons.** Phillips Petroleum Co., Bartlesville, Okla.—160-page Bulletin No. 255 is the third edition of the catalog of the various hydrocarbon products produced by this company. Specifications, principal impurities, typical properties, and containers are listed for each of the grades of each of the hydrocarbons listed.

**131. Blowers.** Roots-Connersville Co., Connersville, Ind.—18-page Bulletin No. 22-23-B-13 describes the various types of rotary positive blowers produced by this company. Accessories are shown and examples of actual applications are given.

**132. Packing.** Crane Packing Co., Chicago, Ill.—This new bulletin is entitled "Packing for the Chemical Industry." It lists the applications of the various types of packing produced by this com-

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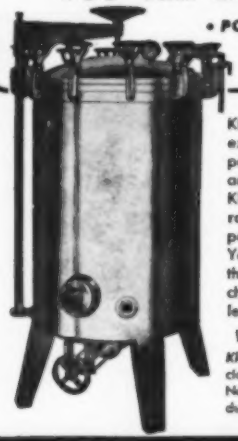


*New York 6; Baltimore 3; Buffalo 3; Chicago 8; Cincinnati 3; Cleveland 13; Pittsburgh 12; St. Louis 1; Boston 6 (National Lead Company of Mass.); Los Angeles 23 (Morris P. Kirk & Son, Inc.); Philadelphia 25 (John T. Lewis & Bros. Co.); Atlanta (Georgia Lead Works, Div. of Cincinnati Branch); Toronto, Canada (Canada Metal Co. Ltd.).*

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pany, and gives information on the new type of chemically inert packings produced from Teflon.

**133. Process Equipment.** Black, Sivalls & Bryson, Ltd., Kansas City, Mo.—Two new bulletins describe the various types of process equipment produced by this company. The first, a 56-page condensed general catalog, briefly describes all the various types of equipment the company produces. Included are heaters, separators, tanks, feeders, and other equipment. The second bulletin, 40-page catalog No. 54, describes in detail the walkways and loading racks produced by this company.

**134. Benzene Hexachloride.** Commercial Solvents Corp., New York, N. Y.—This 8-page bulletin gives data on the chemical and insecticidal properties of benzene hexachloride. A solubility table is included showing the solubility of four of the isomers of this chemical in various common solvents.

**135. Heat Sealing Papers.** Nashua Gummed & Coated Paper Co., Nashua, N. H. —22-page technical manual describes the properties of the various types of heat sealing papers produced by this company. Applications are primarily for the dry labeling and dry packaging field.

**136. Temperature Control Valve.** Powers Regulator Co., Chicago, Ill.—8-page Bulletin No. 329 describes the line of temperature regulating valves produced by this company. They are available over the temperature range of 120 to 190 deg. F and in sizes from ½ in. to 6 in. Complete dimensions and specifications are given.

**137. Activated Carbon.** West Virginia Pulp & Paper Co., New York, N. Y.—12-page booklet entitled "Storage, Handling and Feeding of Activated Carbon" gives detailed information on such things as bag emptying equipment and dry and solution feeding of activated carbon.

**138. Corrosion-Resistant Linings.** Metalweld, Inc., Philadelphia, Pa.—4-page Bulletin K describes the applications and corrosion resistance of the sheet lining material produced by this company made from polyvinyl chloride. Tables are given for the corrosion resistance of this material to various acids, salt solutions, and organic chemicals.

**139. Welding Electrodes.** Lincoln Electric Co., Cleveland, Ohio.—16-page Bulletin No. 466 describes the various types of welding electrodes produced by this company, and includes a guide for the selection of the proper electrode for a given job.

**140. Electric Switches.** W. L. Maxson Corp., New York, N. Y.—8-page Catalog Section No. 492 describes the new switch model produced by this company. Engineering information for correct selection and application of these switches is included.

**141. Floor Trucks.** Rapids Standard Co., Grand Rapids, Mich.—4-page Bulletin No. 42-848 describes the various types of floor trucks produced by this company. Sizes and weight capacities for these trucks are given.

**142. Storage Batteries.** Electric Storage Battery Co., Philadelphia, Pa.—8-page bulletin describes the sealed glass storage batteries produced by this company for stationary power application. It uses a lead-antimony alloy in the positive plates.

**143. Electric Starters.** Allis-Chalmers Mfg. Co., Milwaukee, Wis.—12-page Bulletin No. 14B7132 describes the line of alternating current electric starters produced by this company.

**144. Trailers.** Mercury Mfg. Co., Chicago, Ill.—16-page bulletin No. A-599 describes the various types of trailers




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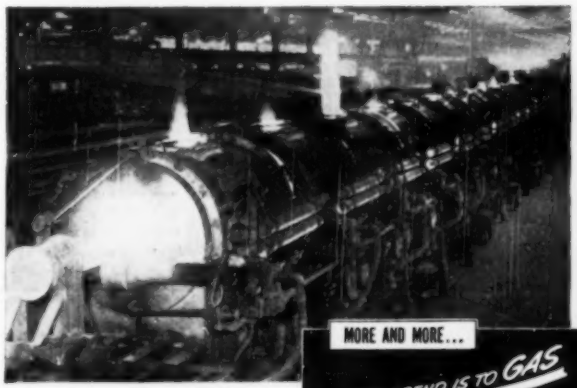
Many types of carbon, alloy and stainless steels are used in the manufacture of seamless tubing at The Babcock & Wilcox Tube Company. During the early stages of tube formation the tubes drop in temperature before entering the sizing mill. The modern Gas-fired units in the Beaver Falls, Pennsylvania, plant perform this reheating operation at speeds up to 162 FPM for 6-inch tubing.

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produced by this company for movement of materials, particularly where heavy loads are involved. These trailers range in capacity from 4,000 to 60,000 lb.

**145. Scaffolds.** Patent Scaffolding Co., New York, N. Y.—4-page Bulletin No. PTS-13 describes the tubular steel scaffolding produced by this company. Advantages and applications of this scaffolding are listed.

**146. Pressure and Temperature Regulators.** O. E. Keckley Co., Chicago, Ill.—4-page catalog No. 48MC describes the line of pressure regulating valves pressure reducing valves, and temperature regulating valves produced by this company. Specifications and dimensions are given. The bulletin also describes the inverted bucket steam traps and strainers produced by this company.

**147. Continuous Weighing.** Builders-Providence, Inc., Providence, R. I.—16-page bulletin No. C4-550 describes the meter produced by this company for continuously weighing and totalizing the flow of dry materials. These machines are designed to weigh material flowing on conveyor belts and applications and methods of installation are shown.

**148. Lift Trucks.** Lift Trucks, Inc., Cincinnati, Ohio.—12-page Bulletin No. K-48 describes the various types of electric lift trucks and fork trucks produced by this company for handling skids and pallets. Dimensions and capacities of the standard sizes available are given.

**149. Butyl Rubber.** Enjay Co., New York, N. Y.—20-page booklet describes methods of processing and compounding of butyl rubber. Specifications of the different types and grades manufactured are given. Information is given on such additives as accelerating agents, vulcanizing agents, and fillers.

**150. Drum Painting Equipment.** Eclipse Air Brush Co., Newark, N. J.—4-page folder describes the automatic drum painting equipment produced by this company. This equipment can paint and stripe up to 450 drums per hr.

**151. Pumps.** Marlow Pump Co., Ridgewood, N. J.—12-page Bulletin No. PM48 describes the line of self-priming centrifugal pumps produced by this company, particularly for use in handling petroleum and other volatile liquids. Complete specifications and capacities are given together with engineering information for use in picking the proper pump to be used for a given installation.

**152. Bottle Filling Machinery.** Mrm Co., Brooklyn, N. Y.—4-page bulletin describes the various types of liquid filling machines produced by this company. Specifications, dimensions and production rates are given. Examples of applications of these machines are also given.

**153. Centrifugal Pumps.** Bell & Gossett Co., Morton Grove, Ill.—4-page bulletin AB-348 gives the dimensions and specifications for the series of centrifugal pumps produced by this company. The pumps range in size fro ¼ to 2 hp.

**154. Resorcinol.** Koppers Co., Pittsburgh, Pa.—15-page bulletin No. C-8-124 describes the properties and uses of Resorcinol. Specifications for the various grades produced are given together with a description of the chemical reactions which this product undergoes. Commercially important applications are discussed.

**155. Stainless Steel Tubing.** Republic Steel Corp., Cleveland, Ohio.—28-page bulletin describes the various types of stainless steel tubing produced by this company. Properties and methods of fabrication are discussed and the bulletin also contains a chart of corrosion data and tables of physical properties for these tubes.

**156. Crusher.** Barber-Greene Co., Aurora, Ill.—8-page Bulletin No. 929 describes the two-stage, four-speed jaw crusher produced by this company. Specifications and approximate capacity for different crushing sizes are given.

**157. Protective Coatings.** Plastic Lining Corp., Chicago, Ill.—8-page bulletin describes the modified copolymer vinyl resin coatings which this company produces. Included in the bulletin is a table showing the corrosion resistance of this coating to various chemicals.



A Link-Belt conveying system in an Iowa meat packing plant, equipped with Allen-Bradley watertight starters.

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Wherever moisture conditions are severe . . . wherever steam or water spray can get into the starter . . . install an Allen-Bradley starter in a watertight enclosure. Under the toughest operating conditions, these A-B watertight starters give long, trouble-free service. Their bolted enclosures present no servicing problem, because the silver-alloy starter contacts require no maintenance.



## BULLETIN 609 MANUAL STARTER . . . In General Purpose Enclosure

For normal industrial applications, this general-purpose enclosure is adequate. The manually operated switch . . . in all Bulletin 609 Starters . . . opens and closes with a quick-make, quick-break action. Overload breakers protect the motor. If tripped by an overload on the motor, the overload breakers can be quickly reset, without opening the switch cabinet, simply by pressing the STOP button. The starter is then ready to restart the motor. Note the white interior.



## BULLETIN 709 MAGNETIC STARTER . . . For Remote Control

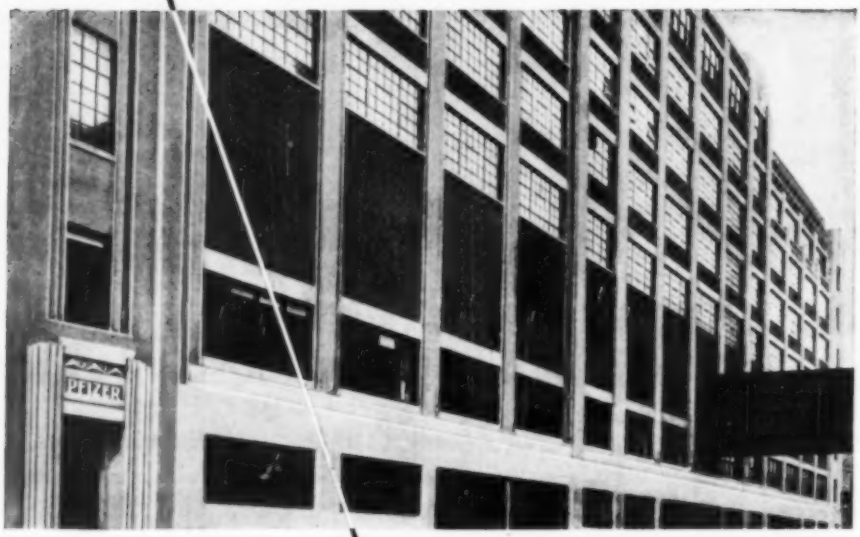
The Bulletin 709 Starter, shown here in a general-purpose enclosure, may be operated by remote control with any form of two- or three-wire pilot device. The Bulletin 709 Starter provides overload protection and no-voltage release. This latter feature prevents the motor from restarting, after a line failure, until the operator again presses the START button. Only one moving part means years of maintenance-free life. Generous wiring space, accessible terminals, and white interior make for a neat and safe installation. Available in all types of enclosures.

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**SOLENOID MOTOR CONTROL**
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*Manufacturing Chemists Since 1849*

# CHEMICAL ECONOMICS

*Richard F. Warren*, ASSISTANT EDITOR

## First Quarter Business Good as Price Drops Point to Normal Competitive Markets

GENERAL business conditions in the process industries continued to keep plants busy in the early months of the year, but some warning indicators such as general employment figures and scattered price drops dampened the prospects of new production records for the coming year. However, with over-all unemployment at the low figure of 2.7 million in January, no great threat to our current prosperity is considered likely. In fact, price drops from artificial highs are healthy signs of our return to normal competitive markets. A good example is found in the drop of ethyl alcohol (SD 1) from a postwar high of 98c. per gal. down to 24c. per gal. in February. While most experts feel this level is too low to be maintained for a great length of time in view of current producing costs, it will not return to its postwar high points in the near future.

This drastic reduction has many ramifications that are not generally recognized. In the past two years acetic anhydride and acid production from ethyl alcohol fell off and many firms practically eliminated production because fermentation ethyl alcohole was too expensive to be used as a raw material. With the return of low prices it may again become a profitable venture. Another reason for an optimistic view of the situation is found in the fact that many firms had been looking forward to the day when they could get alcohol at 35c. per gal. so that they might go ahead with projected plans for new products—now those plans can be dusted off and put into action. Some producers of ethyl esters such as diethyl phthalate stopped production when alcohol prices jumped up and they are studying the possibilities of moving back into the picture.

According to data released by the American Iron and Steel Institute the steel industry spent $538,000,000 in 1948 to expand and improve steel output. The industry plans to spend $627,000,000 this year for the same purposes. In 1948 this expansion added 1,887,000 tons and this year 2,200,000 tons will add to capacities. By the end of the year this will push steel capacities up to 98.3 million tons. Another 500,000 tons will be added in 1950. Comparing the cost of these new projects with the cost of similar projects constructed ten years ago, we find that the cost per ton of steel capacity is more than four times the 1938 level.

*Chemical Engineering Index*

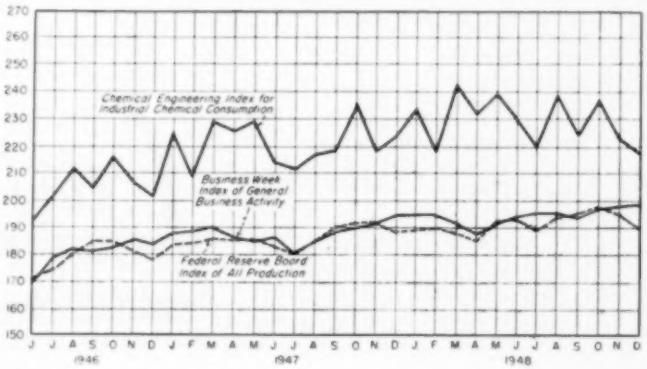
**Industrial Consumption of Chemicals**

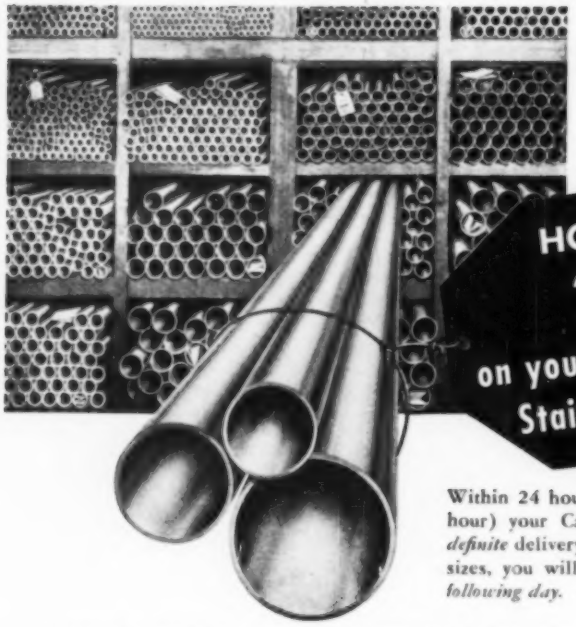
1935 = 100

| | November | December |
|---|---|---|
| Fertilizers | 51.30 | 48.60 |
| Pulp and paper | 24.91 | 22.30 |
| Petroleum refining | 22.20 | 22.21 |
| Glass | 17.55 | 16.35 |
| Paint and varnish | 19.85 | 18.26 |
| Iron and steel | 14.28 | 14.30 |
| Rayon | 27.21 | 27.15 |
| Textiles | 10.15 | 10.08 |
| Coal products | 10.58 | 11.10 |
| Leather | 4.25 | 3.94 |
| Explosives | 8.16 | 7.28 |
| Rubber | 5.31 | 4.81 |
| Plastics | 8.65 | 8.64 |
| INDEX | 224.40 | 217.02 |

Estimates for freight carloadings during the first quarter show that shipments of chemicals are up 3.8 percent over the first quarter of 1948. Total carloadings are estimated to be up 2.1 percent. Chemical shipments in the Southwest are expected to be more than 20 percent higher than the same 1948 period. An additional 1,500 carloads of chemicals will be moved in the first three months of 1949 in the Southwest, according to the Shippers Advisory Board. However, the early reports on actual carloadings indicate that these estimates may be high. But the board's figures show the rapid growth of chemical activities in this region and also reveal the results of the huge expansion programs carried out by the chemical industry in the past twelve months.

Final data on 1948 activities are now becoming available and in general they bear out earlier estimates. Federal Reserve Board index for industrial production shows that the general level of business in December was substantially the same as the level reached in December 1947. The unadjusted combined index stood at 190 in both months. The industrial chemical index was up to 449 in December compared with 438 in December 1947. *Chemical Engineering*'s index of chemical consumption in 1948 was 229.17 compared with 221.85 in 1947.





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  Brown-Wales Company
- **BUFFALO, NEW YORK**
  Service Steel Company
- **CHARLESTON, WEST VIRGINIA**
  The McJunkin Supply Company, Inc.
- **CHICAGO, ILLINOIS**
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  Service Steel Company
- **CLEVELAND, OHIO**
  The Cleveland Tool & Supply Co.
- **DETROIT, MICHIGAN**
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- **ELIZABETH, NEW JERSEY**
  Schnitzer Alloy Products Company
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  Edgcomb Steel Corp.
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# *Carpenter*

## STAINLESS TUBING

**"MORE THAN CORROSION RESISTANCE"**

# Nitric Acid

**John R. Skeen**
*Foster D. Snell, Inc.*




WHETHER in peace or in war, a plentiful supply of nitric acid is essential to the production of dyes, explosives, plastics, leather, fertilizers and many industrial chemicals. About 1.2 million short tons of nitric acid were consumed annually in the civilian economy during the last two years and it appears that this rate will continue indefinitely. Indeed, with the anticipated operation of additional capacity in excess of 100 thousand tons, more may be produced this year than ever before. If, for any reason, this should not be enough, there is existing an idle capacity nearly equal to the amount now in production.

The great increase in nitric acid production from the 1939 level of 168 thousand tons is ascribable entirely to war needs for explosives such as trinitrotoluene, tetryl, picric acid, PETN and RDX. An annual capacity of about 6 billion pounds of these and allied materials was provided and this production was begun by the Chickasaw Ordnance Works late in 1940. In all, about 20 explosives plants were erected of which 11 were primarily for making TNT.* For full operation, the nitric acid requirements have been variously estimated in excess of 1.8 million tons. Capacity was increased just about 10-fold from the prewar level.

Presently, the major limiting factor in the production of nitric acid is the demand for nitrogenous fertilizers and the competition of the various forms of fixed nitrogen for this market. Thus, nitric acid is converted into ammonium nitrate for this use and so competes with anhydrous ammonia, its raw material. This is now applied directly to the land or is converted into urea, urea-ammonia liquors and ammonia-sodium nitrate liquors. The immediate availability of ammonia oxidizing equipment has stimulated the use of ammonia nitrate in recent years.

Nitric acid was originally made by reacting Chili saltpeter with sulphuric acid. Five years ago, only 15 thousand tons were so produced and the amount is even less today. Early in the century, Wilhelm Ostwald developed a process for making nitric acid by the oxidation of ammonia in the presence of a platinum catalyst. The only ammonia available was obtained from byproduct coke ovens. The impurities rapidly poisoned the catalyst and the price made the process unprofitable. With the advent of the Haber process for making synthetic ammonia in 1913, the Germans initiated the Ostwald method successfully. After the war began, W. S. Landis developed this method for the American Cyanamid Co. and, in all, three small plants were erected. The Semet-Solvay Co., in conjunction with the Bureau of Mines, began experimental work in 1916. This resulted in a new form of the platinum catalyst and was used in the Muscle Shoals plant which opened two years later.

However, the oxidation procedure attained no importance until the price of anhydrous ammonia fell from 30c. to 15c. per lb. in 1925. Three years later, E. I. du Pont de Nemours & Co., Inc., erected three plants and Hercules Powder Co. announced that it intended to abandon the saltpeter method in favor of the oxidation process. Others rapidly followed. Small units sprang up nearly everywhere.

Perhaps the first significant use for nitric acid was to make nitrobenzene for reduction into aniline, the starting point in the synthesis of Perkin's mauve. In 1872 the Hyatts began making celluloid, the first of the plastics, in Newark, N. J. The development of high explosives was a German contribution nearly 30 years later. These three uses grew rapidly so that nitric acid became identified as an intermediate and dye chemical, and a nitrating agent in the manufacture of celluloid and explosives. These uses remain. About 20 years ago, nitric acid was converted into ammonium nitrate for consumption as a fertilizer. The market was small and unimportant in relation to other fixed nitrogen forms. It was not until the last war, with the immediate availability of the ammonium salt from the explosive plants, that the fertilizer aspect attained significance. It has become the dominant outlet for the acid.

The oldest and largest producers are Du Pont, Hercules and Allied Chemical and Dye Corp. Until the war, these three accounted for over 70 percent of the domestic production. Production has become more distributed in recent years with the entry into the field of Lion Chemical Co. at El Dorado, Ark., and Spencer Chemical Co. at Pittsburg, Kan. If the plans of the Mississippi Chemical Corp. materialize this year, still another new member will be added to this industry. In addition, the Army will make equipment of the Cactus Ordnance Works available to Phillips Petroleum Co.

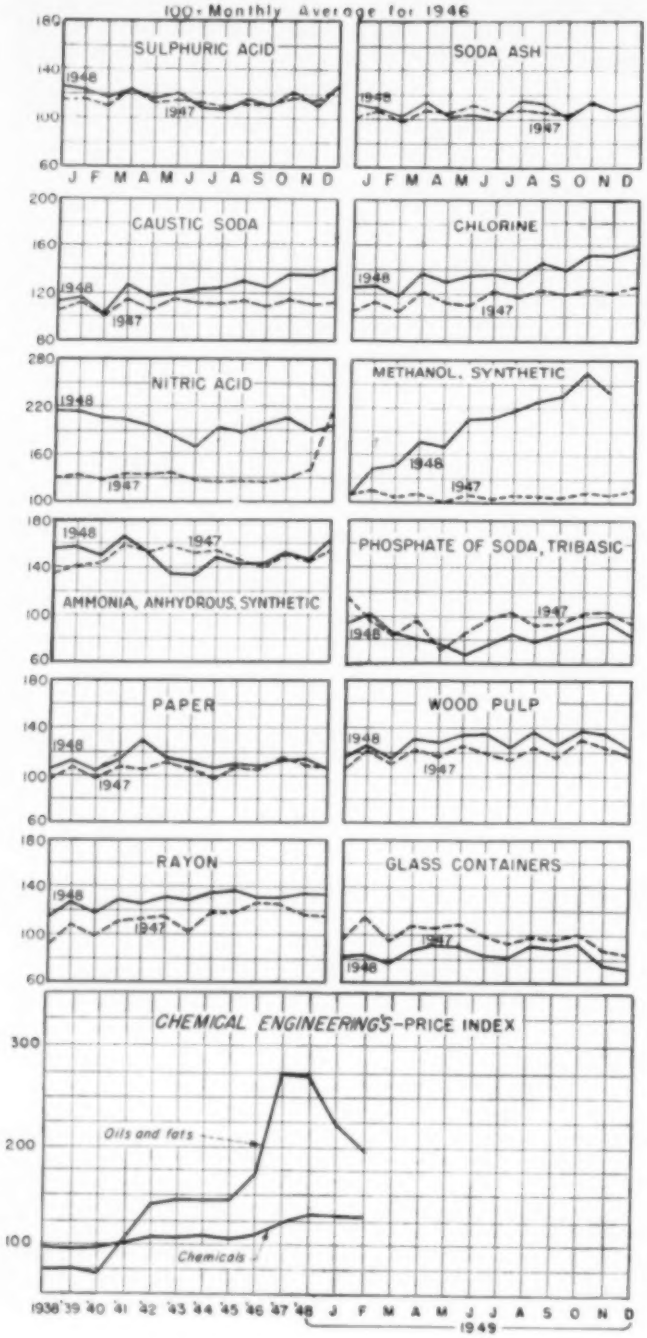
## Statistical Review

Unit: Short Tons

| | Production[1] | Plant[2] Consumption | Plants[2] Number | Producers[2] Number | Use, Percent[3] Plastics[4] | Ammonium Nitrate[5] | Explosives[6] | Price[4] C. per Lb. |
|---|---|---|---|---|---|---|---|---|
| 1929 | 143,354 | 110,493 | 48 | ... | ... | ... | 66 | 6.5 |
| 1931 | 117,249 | 85,819 | 34 | ... | ... | ... | ... | 6.5 |
| 1933 | 93,637 | 66,056 | 28 | ... | ... | ... | ... | 6.5 |
| 1935 | 96,109 | 71,608 | 30 | 15 | 12 | ... | ... | 6.5 |
| 1937 | 175,880 | 140,450 | 30 | 15 | 10 | ... | 63 | 6.5 |
| 1939 | 167,740 | 133,169 | 27 | 12 | 8 | 8 | 43 | 6.5 |
| 1941 | 347,300 | 280,847 | ... | ... | 5 | ... | ... | 6.5 |
| 1942 | 426,624 | 343,451 | ... | ... | 4 | ... | ... | 6.5 |
| 1943 | 485,248 | 395,900 | 30 | ... | 3 | 62 | ... | 6.5 |
| 1944 | 471,717 | 413,207 | ... | ... | ... | 72 | ... | 6.5 |
| 1945 | 447,068 | 418,604 | 21 | 12 | 3 | ... | ... | 6.5 |
| 1946 | 573,827 | ... | 23[8] | 16[9] | 3 | ... | ... | 6.5 |
| 1947 | 1,100,000 | ... | 25 | 17 | 1 | 69 | 18[10] | 6.5 |
| 1948 1Q | 305,421 | ... | ... | ... | ... | ... | ... | 6.5 |
| 2Q | 263,279 | ... | ... | ... | ... | ... | ... | 6.5 |
| 3Q | 278,482 | ... | ... | ... | ... | ... | ... | 6.5 |

[1]Census of Manufactures, 1929-39; 1941-; Facts for Industry, M19A and supplements; exclusive of government plants. [2]As (0) except 1945 is only approximate. [3]As (0) except after 1945 when these Ordnance plants were privately operated and reported to Census: Spencer-Jayhawk at Pittsburg, Kan.; Lion-Ozark at El Dorado, Ark.; Solvay-Buckeye at South Point, Ohio; and the Mathieson-DPC plant at Lake Charles, La. [4]Authorities various: 1937-39, unofficial government summaries; 1945, Murray Hearings, p. 199. [5]Approximate and unofficial. [6]Bureau of Labor Statistics; 42 deg., carboys, c.l., f.o.b. works. [7]Cellulose nitrate, sheets and rods. [8]Before 1939 use was small and the fertilizer grade was supplied by one producer; fertilizer use has been dominant and, in 1947, amounted to 856,000 tons of ammonium nitrate or 56 percent of the total $HNO_3$. [9]Unofficial government estimates 1929, 1937, 1939; 1947, see also *Chemical and Metallurgical Engineering*, Sept. 1939; explosives consumption for government not included. [10]See also Publication No. 179, Tennessee State Planning Com., Aug. 1947; this lists 26 plants and 15 producers. [11]Correct value is reliably reported to lie between 15 and 20 percent. [12]In August, announcements were made that Mississippi Chemical Corp. planned a capacity of 225-250 tons per day of $HNO_3$ as part of its fertilizer program; that equipment at the Point Pleasant, W. Va., and Sandusky, Ohio, Ordnance plants was bought from WAA by General Chemical Div. for installation at its Newell, Pa., plant, and that the Army made oxidizing equipment at Cactus available to Phillips Petroleum Co.

# PRODUCTION, CONSUMPTION AND PRICE TRENDS




PRODUCTION activities in the process industries are continuing to pour out vast quantities of supplies with a growing synthetic detergent industry setting the pace. According to R. M. Prather, speaking at a recent CMRA meeting, total production of the major components in these synthetics has grown from 155 million pounds in 1944 to 590 million pounds in 1948.

Inorganic chemical output as reported by the government shows that in November production of synthetic ammonium sulphate and caustic soda hit new highs. Chlorine had its second best month in history last November with output only 142 tons below the October peak.

Organic production in November was also in high gear. Acetic anhydride was up to a rate of 880 million pounds per year. Acetone's annual rate of output reached 530 million pounds in November, and production rate of primary normal butyl alcohol was over 181 million pounds per year. DDT staged a comeback late in the year and from a low of 355,262 pounds made in June, it rose to a high of 2,679,474 pounds in November. Phthalic anhydride reached an annual rate of 191 million pounds in the same month. Toluene from coke oven operators hit a high for the year when production rates rose to more than 29 million gallons per year.

## Price Trends

Isopropyl alcohol prices were forced down last month by the continuing fall in ethyl alcohol price structure. With Cuban molasses prices tied to ethyl, Cuban sugar interests are bucking any further cuts and are looking for ways to dispose of molasses in more profitable channels. Oils and fats followed the same downward trend in February and *Chemical Engineering's* price indexes reflected the over-all movement. Lead markets eased last month and while no drop occurred in February, experts look for a downward movement in lead and lead pigments unless demand increases.

**Chemical Engineering**

WEIGHTED INDEXES OF PRICES

Base = 100 for 1937

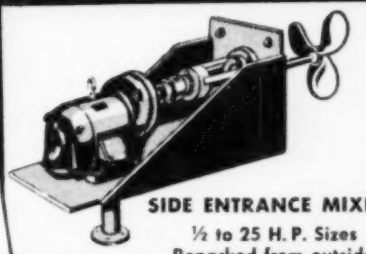
| | Chemicals | Oils & Fats |
|---|---|---|
| As of March 1 | 127.94 | 189.92 |
| Last Month | 130.29 | 199.61 |
| March 1948 | 128.80 | 265.67 |
| March 1947 | 123.15 | 340.19 |

# "International"

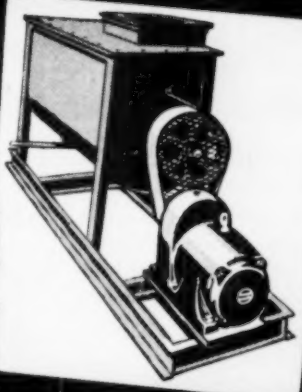
## Chemical Processing Equipment



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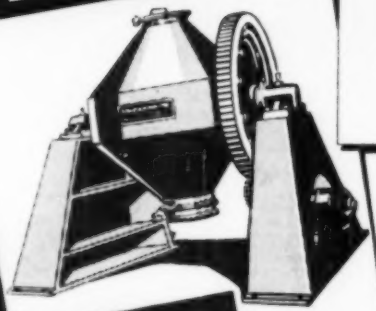
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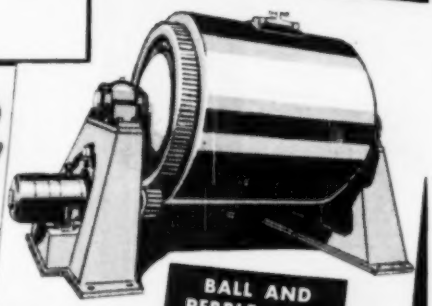
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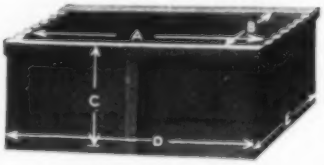
Made in 15 standard sizes from 15 gallons to 500 gallons (with or without outlets, covers, etc.)

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Made in 7 standard sizes from 2½ gallons to 30 gallons (with or without outlets, covers, etc.)





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• Write for Bulletin 405M •

421 A

U. S. STONEWARE
Akron 9, Ohio

## United States Production of Certain Chemicals

November 1948, November 1947 and Eleven-Month Totals for 1948 and 1947

| Chemical (Tons unless otherwise noted) | November 1948 | November 1947 | Total, Eleven Months 1948 | Total, Eleven Months 1947 |
|---|---|---|---|---|
| Ammonia, synthetic, anhydrous[1] | 88,794 | 92,185 | 985,354 | 1,014,798 |
| Ammonium nitrate | 79,222 | 86,214 | 904,874 | 954,452 |
| Ammonium sulphate, synthetic technical (M lb.) | 46,147 | 29,748 | 338,642 | 353,507 |
| Calcium arsenate (M lb.) | | 2,709 | | 42,728 |
| Calcium carbide, commercial | 55,347 | 48,462 | 625,933 | 563,894 |
| Calcium phosphate: | | | | |
| Monobasic (M lb.) | 6,516 | 6,698 | 66,435 | 59,372 |
| Dibasic (M lb.) | 9,631 | 4,921 | 73,405 | 67,502 |
| Carbon dioxide: | | | | |
| Liquid and gas (M lb.)[2] | 15,215 | 16,537 | 227,434 | 237,197 |
| Solid (M lb.) | 48,310 | 44,831 | 632,009 | 628,805 |
| Chlorine | 147,451 | 124,634 | 1,468,502 | 1,409,092 |
| Chrome green (M lb.) | 980 | 952 | 11,061 | 13,086 |
| Chrome yellow and orange, (C.P.) (M lb.) | 3,908 | 4,289 | 44,478 | 44,821 |
| Hydrochloric acid | 38,948 | 32,506 | 394,411 | 396,900 |
| Hydrogen (M cu. ft.) | 2,507,000 | 2,111,000 | 25,363,000 | 18,827,000 |
| Lead arsenate, acid and basic (M lb.) | | | | |
| Molybdate chrome orange, (C.P.) (M lb.) | 500 | 747 | 5,952 | 5,971 |
| Nitric acid | 91,349 | 101,558 | 1,036,723 | 940,596 |
| Oxygen (M cu. ft.) | 1,286,000 | 1,212,000 | 14,539,000 | 12,542,000 |
| Phosphoric acid (50% $H_3PO_4$) | 104,137 | 89,353 | 1,006,704 | 947,705 |
| Soda ash: | | | | |
| Ammonia-soda process: | | | | |
| Total wet and dry[3] | 398,158 | 379,851 | 4,169,426 | 4,129,488 |
| Finished light[3] | 211,680 | 185,558 | 1,820,830 | 1,904,583 |
| Finished dense | 125,252 | 136,257 | 1,403,891 | 1,341,261 |
| Natural[3] | 19,186 | 24,903 | 274,814 | 256,786 |
| Sodium bicarbonate, refined | 11,973 | 15,663 | 147,415 | 106,461 |
| Sodium bichromate and chromate | 8,277 | 7,527 | 87,393 | 79,891 |
| Sodium hydroxide: | | | | |
| Electrolytic process: | | | | |
| Liquid[4] | 106,778 | 119,879 | 1,432,909 | 1,261,308 |
| Solid | 26,172 | 25,140 | 276,594 | 219,459 |
| Limesoda process: | | | | |
| Liquid[4] | 65,716 | 61,419 | 703,153 | 697,928 |
| Solid | 23,216 | 19,963 | 232,940 | 224,198 |
| Sodium phosphate: | | | | |
| Monobasic | 1,187 | 1,109 | 10,014 | 12,993 |
| Dibasic | 8,765 | 7,436 | 77,702 | 75,783 |
| Tribasic | 7,365 | 8,251 | 73,396 | 81,459 |
| Meta | 3,357 | 2,784 | 32,004 | 27,476 |
| Tetra | 5,935 | 5,025 | 60,416 | 50,766 |
| Sodium silicate, anhydrous | 46,988 | 45,233 | 435,817 | 458,626 |
| Sodium sulphate: | | | | |
| Anhydrous, refined | 14,638 | 10,992 | 131,231 | 128,294 |
| Glauber's salt[5] | 13,427 | 16,573 | 170,333 | 179,434 |
| Salt cake[6] | 38,294 | 34,672 | 397,534 | 402,152 |
| Sulphuric acid:[7] | | | | |
| Chamber process | 255,277 | 280,925 | 2,732,788 | 3,037,820 |
| Contact process, new | 638,417 | 548,509 | 6,651,487 | 5,987,931 |

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1]Includes a small amount of aqua ammonia. [2]Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3]Not including quantities converted to finished dense. [4]Data collected in cooperation with the Bureau of Mines. [5]Figures represent total production of liquid materials, including quantities evaporated to solid caustic and reported as such. [6]Includes oleum grades, excludes spent acid. [7]Data for sulphuric acid manufactured as a byproduct of smelting operations are included.

## United States Production of Certain Organic Chemicals

November 1948, November 1947 and Eleven-Month Totals for 1948 and 1947

| | November 1948 | November 1947 | Total, Eleven Months 1948 | Total, Eleven Months 1947 |
|---|---|---|---|---|
| Acetic acid | | | | |
| Synthetic | 38,992,372 | 28,027,807 | 373,265,786 | 331,009,024 |
| Recovered | 156,259,882 | 133,448,552 | 1,593,099,401 | 1,339,347,396 |
| Natural[1] | 2,246,074 | 2,410,848 | 23,983,278 | 23,798,809 |
| Acetic anhydride[2] | 73,450,130 | 55,346,923 | 704,564,422 | 562,261,710 |
| Acetone | 44,430,492 | 34,955,530 | 442,661,391 | 360,879,140 |

(Continued on page 356)

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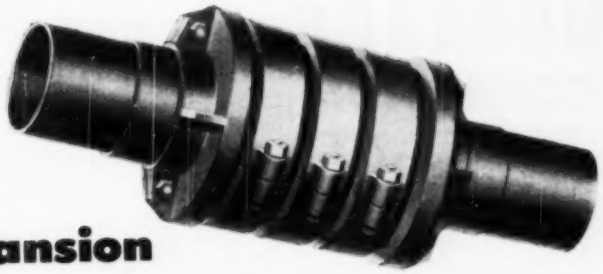
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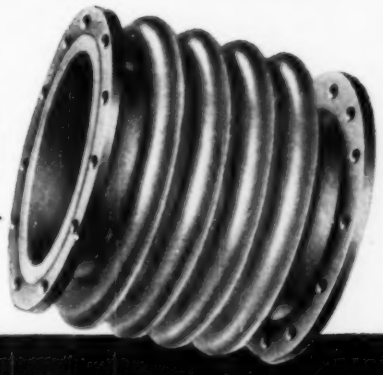


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*Fig. F-80*

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U. S. Production of Synthetic Organic Chemicals (Cont. from page 554.)

| | November 1948 | November 1947 | Total, Eleven Months 1948 | Total, Eleven Months 1947 |
|---|---|---|---|---|
| Acetic acid: | | | | |
| Acetylsalicylic acid | 1,067,004 | 1,015,877 | 8,690,104 | 11,346,977 |
| Aniline | 6,213,145 | 9,279,801 | 86,579,487 | 98,308,659 |
| 5-Ethyl-5-phenylbarbituric acid and salts (phenobarbital)[1] | 33,506 | 42,560 | 332,229 | 436,777 |
| Benzene: | | | | |
| Motor grade: | | | | |
| Coke-oven operators[2] | 635,714 | 1,030,437 | 7,066,337 | 14,914,138 |
| All other grades: | | | | |
| Tar distillers[3] | 980,464 | 1,718,917 | 28,079,176 | 19,637,706 |
| Coke-oven operators[2] | 13,425,636 | 12,396,706 | 134,947,948 | 129,338,717 |
| Butyl alcohol, primary, normal | 15,086,948 | 10,819,771 | 126,453,284 | 128,824,021 |
| Carbon bisulphide | 35,983,931 | 30,733,977 | 370,580,709 | 321,280,166 |
| Carbon tetrachloride | 18,304,730 | 18,057,688 | 192,222,648 | 181,195,593 |
| Chlorobenzene, mono | 25,339,446 | 27,296,009 | 266,539,417 | 297,462,867 |
| Creosote oil | | | | |
| Tar distillers[3] | 11,004,341 | 9,340,201 | 101,436,887 | 111,236,630 |
| Coke-oven operators[2] | 2,431,780 | 3,233,105 | 31,611,042 | 36,040,578 |
| Cresols, meta-para[4] | 783,364 | 659,286 | 8,352,954 | 5,827,399 |
| Cresols, ortho-meta-para[4] | 731,791 | 462,525 | 8,854,361 | 8,095,731 |
| Cresylic acid, refined[4, 5] | 2,569,511 | 2,056,225 | 25,168,390 | 23,852,390 |
| Dibutyl phthalate | 1,544,567 | 2,480,110 | 14,963,697 | 19,915,733 |
| Dichlorodiphenyltrichloroethane, (DDT) | 2,679,474 | 2,562,496 | 15,237,688 | 44,857,479 |
| Ethyl acetate, (85%) | 4,904,015 | 7,131,943 | 58,999,773 | 76,998,148 |
| Ethylene glycol | 31,872,093 | 22,103,140 | 327,367,051 | 201,725,708 |
| Ethyl ether | 3,176,936 | 3,268,346 | 32,795,857 | 37,581,345 |
| Formaldehyde, (37%) | 50,099,905 | 43,085,630 | 573,303,821 | 472,712,314 |
| Hexachlorocyclohexane | 1,127,205 | 1,187,582 | 14,080,509 | 6,203,821 |
| Methanol, natural[6] | 1,271,560 | 1,520,069 | 14,675,398 | 16,973,825 |
| Methanol, synthetic | 99,472,687 | 45,367,780 | 921,453,792 | 403,708,232 |
| Naphthalene: | | | | |
| Tar distillers, less than 79° C. | 16,528,666 | 16,117,925 | 191,881,997 | 205,559,783 |
| Tar distillers, 79° C. and over | 6,571,444 | 7,151,304 | 86,419,574 | 69,047,958 |
| Coke-oven operators, less than 79° C. | 9,308,245 | 7,965,334 | 92,614,873 | 85,240,733 |
| Penicillin and salts[6] | 8,141,914 | 4,870,062 | 85,772,093 | 35,509,659 |
| Phenol | 25,663,725 | 23,825,406 | 264,744,127 | 243,315,855 |
| Phthalic anhydride | 15,920,745 | 12,373,035 | 144,035,597 | 128,088,626 |
| Styrene, government and private plants | 22,980,089 | 26,168,453 | 244,074,380 | 280,430,596 |
| Toluene: | | | | |
| Coke-oven operators | 2,475,516 | 2,410,181 | 26,024,658 | 24,651,995 |
| All other[7] | 3,579,581 | 4,683,474 | | 33,883,244 |
| Xylene, crude | 4,618,445 | 2,271,495 | 54,960,102 | 36,391,254 |

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1]Excludes the statistics on recovered acid. [2]Acid produced by direct process from wood and from calcium acetate. [3]All acetic anhydride including that from acetic by vapor-phase process. [4]Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5]Statistics are given in terms of bulk medicinals only. [6]Statistics collected by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Reported to U. S. Bureau of the Census. [9]Includes toluene produced from petroleum by any process. [10]Includes refined cresylic acid from petroleum.


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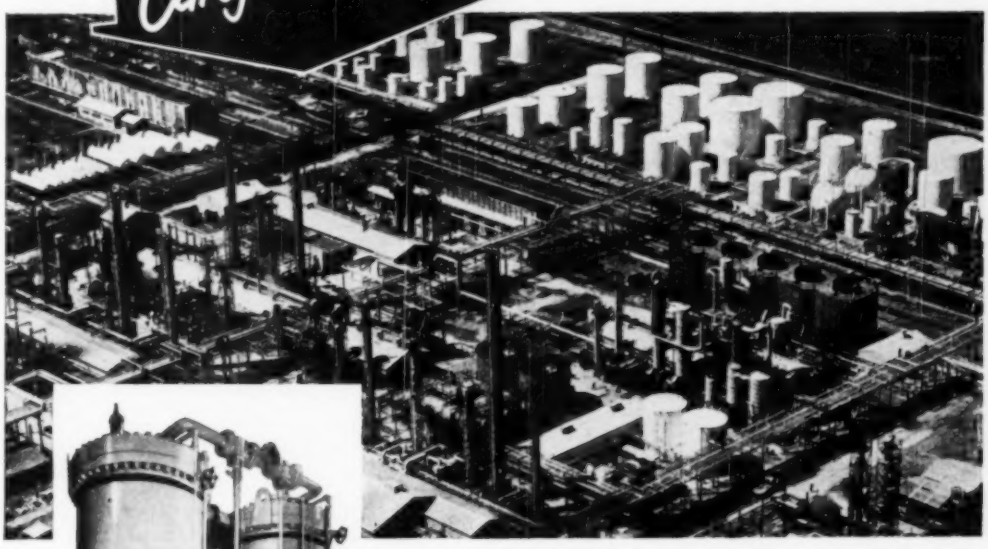
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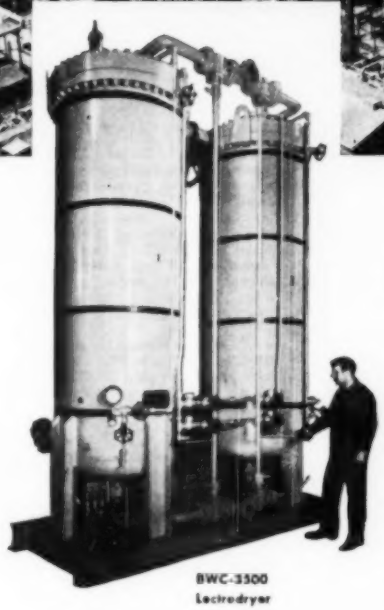
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# NEW CONSTRUCTION

## Proposed Work

Calif., Redwood City—Union Oil Co. of California, 425 First St., San Francisco, plans to construct a petroleum products distribution plant and temporary wharf. Estimated cost $125,000.

Conn., West Haven—Armstrong Rubber Co., 475 Elm St., plans to construct a 2 story, 60x100 ft. factory. Fletcher-Thompson, Inc., 211 State St., Bridgeport, Archts. Estimated cost $70,000.

Ill., Northbrook—International Minerals & Chemical Corp., 20 North Wacker Dr., Chicago, plans to construct a 2 story factory. Herbert Banse, 53 West Jackson Blvd., Chicago, Archt. Estimated cost $200,000.

Ind., Whiting—Standard Oil Co. of Indiana, 910 South Michigan Ave., Chicago, Ill., plans to construct a high pressure research laboratory addition. Holabird, Root & Burgee, 333 North Michigan Ave., Chicago, Archts. Estimated cost $150,000.

Kan., Kansas City — Colgate-Palmolive-Peet Co., 105 Hudson St., Jersey City, N. J., plans to construct a manufacturing plant here. Estimated cost will exceed $2,000,000.

Mich., Flint—Ottawa River Paper Co., Matzinger Rd., Toledo, O., plans to construct a 1 story factory to contain 25,000 sq. ft. floor space, for the manufacture of corrugated paper boxes. MacKenzie, Knute & Klein, Flint, Archts. Estimated cost $100,000.

Pa., Newtown Square—Sun Oil Co., 1608 Walnut St., Philadelphia, plans to construct five factory buildings to include research laboratory and refining and processing plants. Frederick G. Frost, Jr., 1400 East 30th St., New York, N. Y., Archt. Estimated cost $3,000,000.

Pa., West Elizabeth—Pennsylvania Industrial Chemical Corp., 120 State St., Clairton, plans to construct a distillation plant for separation of precision fractions of aromatic oils. Estimated cost $80,000.

Tex., Houston—Phillips Petroleum Co., c/o K. S. Adams, Pres., Bartlesville, Okla., plans to construct a bulk chemical handling plant. Estimated cost $1,250,000.

Tex., San Antonio—Southwest Research Institute, c/o Tom Slick, Milam Bldg., plans to construct an automotive research laboratory and experimental shop. Estimated cost $100,000.

Wash., Vancouver—Buffalo Electro Chemical Co., River Rd. and Sawyer Ave., Tonawanda, N. Y., plans to construct a plant here. Estimated cost $1,000,000.

W. Va., Clarksburg—Hope Natural Gas Co., Clarksburg, plans to construct a 1 and 2 story, 100x150 ft. shop and warehouse. Frank McEntee, Goff Bldg., Eng. Estimated cost $1,000,000.

| | Current Projects | | Cumulative 1949 | |
|---|---|---|---|---|
| | Proposed Work | Contracts | Proposed Work | Contracts |
| New England | 870,000 | $818,000 | 870,000 | $886,000 |
| Middle Atlantic | 3,080,000 | 1,136,000 | 152,825,000 | 2,553,000 |
| South | 1,000,000 | 1,100,000 | 2,213,000 | 6,286,000 |
| Middle West | 150,000 | 2,565,000 | 10,518,000 | 5,790,000 |
| West of Mississippi | 3,350,000 | 6,870,000 | 27,425,000 | 8,715,000 |
| Far West | 1,125,000 | | 2,125,000 | 100,000 |
| Canada | 1,375,000 | 6,000,000 | 15,015,000 | 11,690,000 |
| Total | $10,650,000 | $18,489,000 | $210,221,000 | $35,880,000 |

Ont., Toronto—Dulcr Plastics, Ltd., 37 Hanna Ave., plans to construct a 2 story factory to contain 60,000 sq. ft. floor space on Dobbie Ave. Estimated cost $150,000.

Que., Montreal—E. Ganow, 3999 Ricard St., plans to construct a plant for the treatment of mineral "Priorite" and its byproducts. Estimated cost $1,000,000.

Que., Montreal—St. Regis Paper Co., Ltd., Canada Cement Bldg., plans to construct a 1 story, 80x90 ft. factory. Estimated cost $100,000.

Que., St. Anne de Bellevue—McGill University, Montreal, Que., plans to construct a gas dynamics research laboratory at MacDonald College. Estimated cost $325,000.

## Contracts Awarded

Conn., Bridgeport—Buckley Bros., Inc., 1 Seaview Ave., plans to construct an oil plant. Work will be done by separate contracts. Estimated cost $750,000.

Del., Claymont—General Chemical Co., 1100 Lane St., Camden, N. J., has awarded the contract for the construction of a warehouse to E. F. Kamp Co., 98 Park Pl., New York, N. Y. Estimated cost will exceed $68,000.

Ill., Chicago—Santay Corp., 351 North Crawford Ave., has awarded the contract for an addition to its plastics manufacturing plant to Melvin A. Nelson, 4633 North Hermitage St. Estimated cost $70,000.

Ill., East St. Louis—Sova Feed & Oil Corp., 422 South Front St., has awarded the contract for 2 story factory buildings to Chemical Plants Div. of Blaw-Knox Co., 321 Pennsylvania Ave., Pittsburgh, Pa. Estimated cost $800,000.

Ill., Lockport—Globe Oil & Refining Co., 59 East Van Buren St., Chicago, has awarded the contract for an additional unit for catalytic cracking petroleum refinery to Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago. Estimated cost $1,500,00.

Ill., North Chicago—Abbott Laboratories, Inc., North Chicago, has awarded the contract for a 2 story fermentation building to Carroll Construction Co., 333 North Michigan Ave., Chicago. Estimated cost $195,000.

La., Shreveport—Bird Roofing Co., c/o Rust Engineering Co., contractor, Clark Bldg., Pittsburgh, Pa., will construct a felt mill addition. Estimated cost $1,000,000.

Mo., St. Louis—Hadley Bros. Uhl Co., 3952 West Pine St., has awarded the contract for a 1 story, 70x107 ft. 82x200 ft. and 25x50 ft. factory building for the manufacture of rubber cement to V & M Contracting Co., 4030 Chouteau Ave. Estimated cost $100,000.

N. J., Clifton—Allen B. DuMont Laboratories, Inc., 2 Main Ave., Passaic, N. J., has awarded the contract for a tube plant to Wem Bros. & Storms Co., McLean Blvd. and 9th Ave., Paterson. Estimated cost $500,000.

N. J., Trenton—Scammell China Co., 300 Third Ave., will construct a 2 story, 48x148 ft. manufacturing building and office. Work will be done by separate contracts. Estimated cost will exceed $68,000.

Pa., Creighton—Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, has awarded the contract for a 2 story, 100x400 ft. addition to its plant to The Austin Co., Union Trust Bldg., Pittsburgh and Cleveland, O. Estimated cost $500,000.

Tenn., Nashville—Franklin Limestone Co., 612 10th Ave., N., has awarded the contract for an asphalt mixing plant to Wright Contracting Co., 504 25th Ave., Columbus, Ga. Estimated cost $100,000.

Tex., Bishop—H. R. Smith & W. C. McBride, Bishop, will construct a small oil refinery unit. Work will be done by owners. Estimated cost $70,000.

Tex., Electra—Texas Co., Texas Bldg., Houston, will modernize and enlarge its gasoline refinery here. Work will be done by owners. Estimated cost $700,000.

Tex., Houston—Phillips Chemical Co., Bartlesville, Okla., has awarded the contract for the design and construction of an ammonia sulphate plant at Irish Bend on Houston Ship Channel, to Chemical Construction Corp., 350 5th Ave., New York, N. Y. Estimated cost $6,000,000.

R. I., Warren—Anchorage Plastic Corp., 57 Miller St., will construct a factory. Work will be done by owners. Estimated cost $68,000.

Alta., Devon—Imperial Oil, Ltd., Princess St., Toronto, Ont., has awarded the contract for a gasoline absorption plant and compressor station to C. F. Bawan Co., Alhambra, Calif. Estimated cost $6,000,000.

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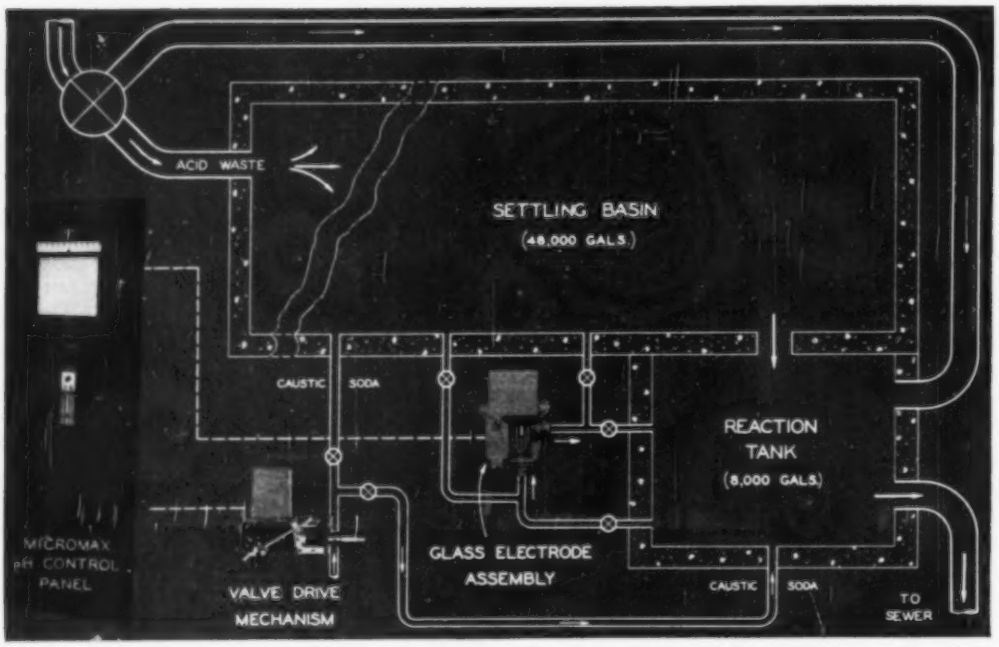
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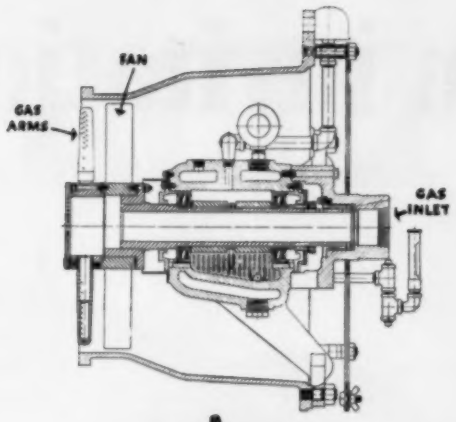
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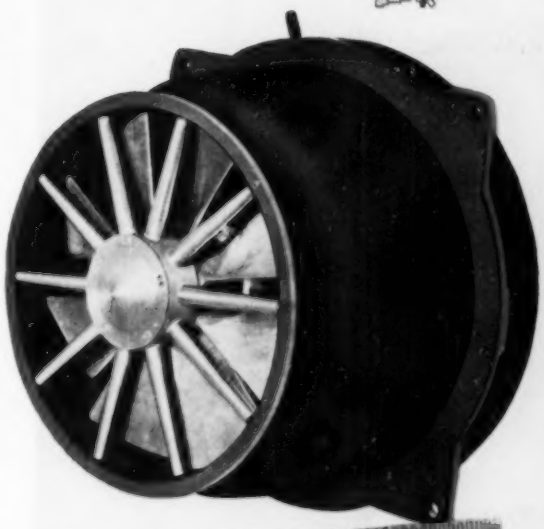
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When you see in Bulletin 410-6 how fuel escaping from orifices in rotating driver arms rotates the fan to draw the correct proportion of air into the path of the fuel at right angles . . . how **FANMIX** creates its own forced draft, reduces stack requirements, prevents cracking of "wet" gas . . . how two **FANMIX** types handle either gas or oil or any combination of both — you'll understand why **FANMIX** Burners have such wide acceptance in oil refineries and power plants.

Send for the Coppus-Dennis **FANMIX** Bulletin 410-6. Coppus Engineering Corporation, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, and REFINERY CATALOG.



ANOTHER
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"BLUE RIBBON" PRODUCT

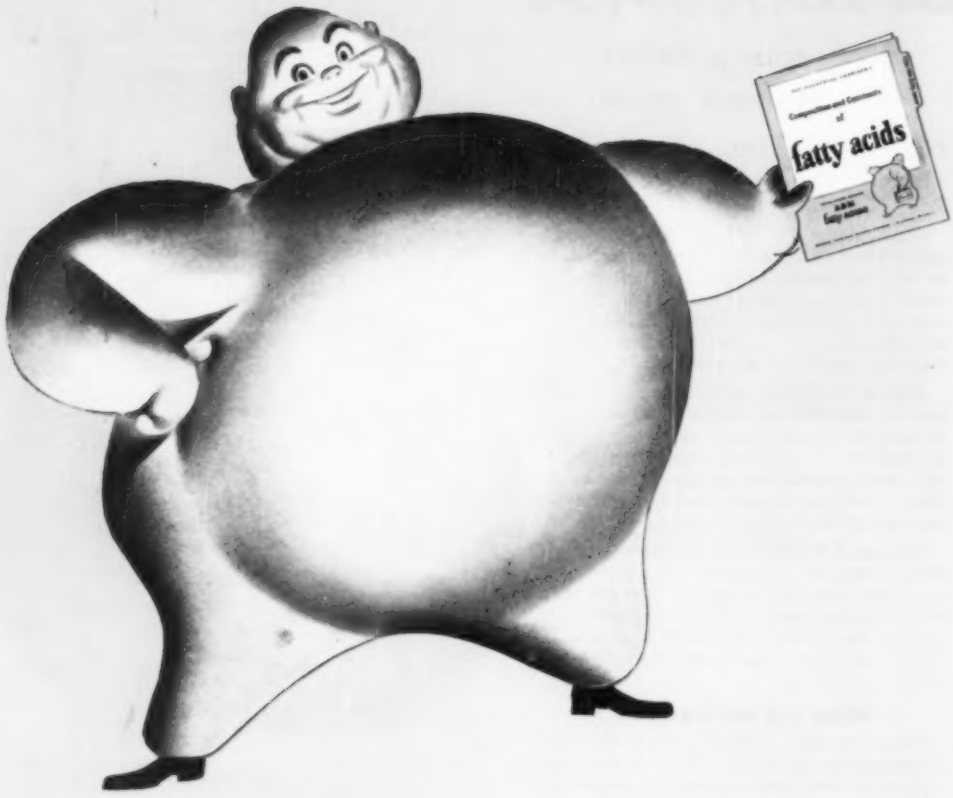
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**223 Park Ave., Worcester 2, Mass.**
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# an invitation from Mr.




Take the Scientific Shortcut with . . .

**ADM fatty ACIDS**

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# fatty acid

It's wonderful, isn't it, to see an old friend rise to fame.

In the case of Mr. Fatty Acid, his spectacular achievements of recent years have brought a lot of pride and satisfaction to Archer-Daniels-Midland Co. We "knew him when". Twenty years ago people called him worthless. Ten years ago this contempt had turned to mild interest in his remarkable abilities. Five years ago, the name Fatty Acid began to be heard in the talk of chemists everywhere. And today the Fatty Acid boom is on in earnest.

Your own program, whether it involves cosmetics or alkyd resins, pharmaceuticals or lubricants, will most certainly involve more and more study of Fatty Acids in the future. Such study will bring you, quite logically, to a common interest with ADM research.

Archer-Daniels-Midland, as the nation's largest processor of vegetable oils, was also one of the first producers of water white and regular Fatty Acids, from linseed and soybean oils. Today our list of products in this field is extensive, and as varied as the needs of industry.

We invite your inquiries about any product, any problem, involving Fatty Acids. In general, ADM can pledge unexcelled laboratory facilities . . . unique experience . . . absolute uniformity of product . . . nationwide distribution . . . and fast, alert service through a large, technically trained sales staff.

An unusual new folder prepared by our research staff, comparing many Fatty Acid materials side by side, is now ready for mailing. May we send you a copy? Your name on the coupon will bring it promptly.

## NEW!

**Folder showing composition and constants of fats and oils**

This folder—the result of ADM research and correlation of existing data—will be useful and valuable to chemists in all industrial fields. It shows constants and compositions of all commercially available fats and oils, and other comparative information. In addition to containing the mean analysis of each product, it also shows the range of analyses.




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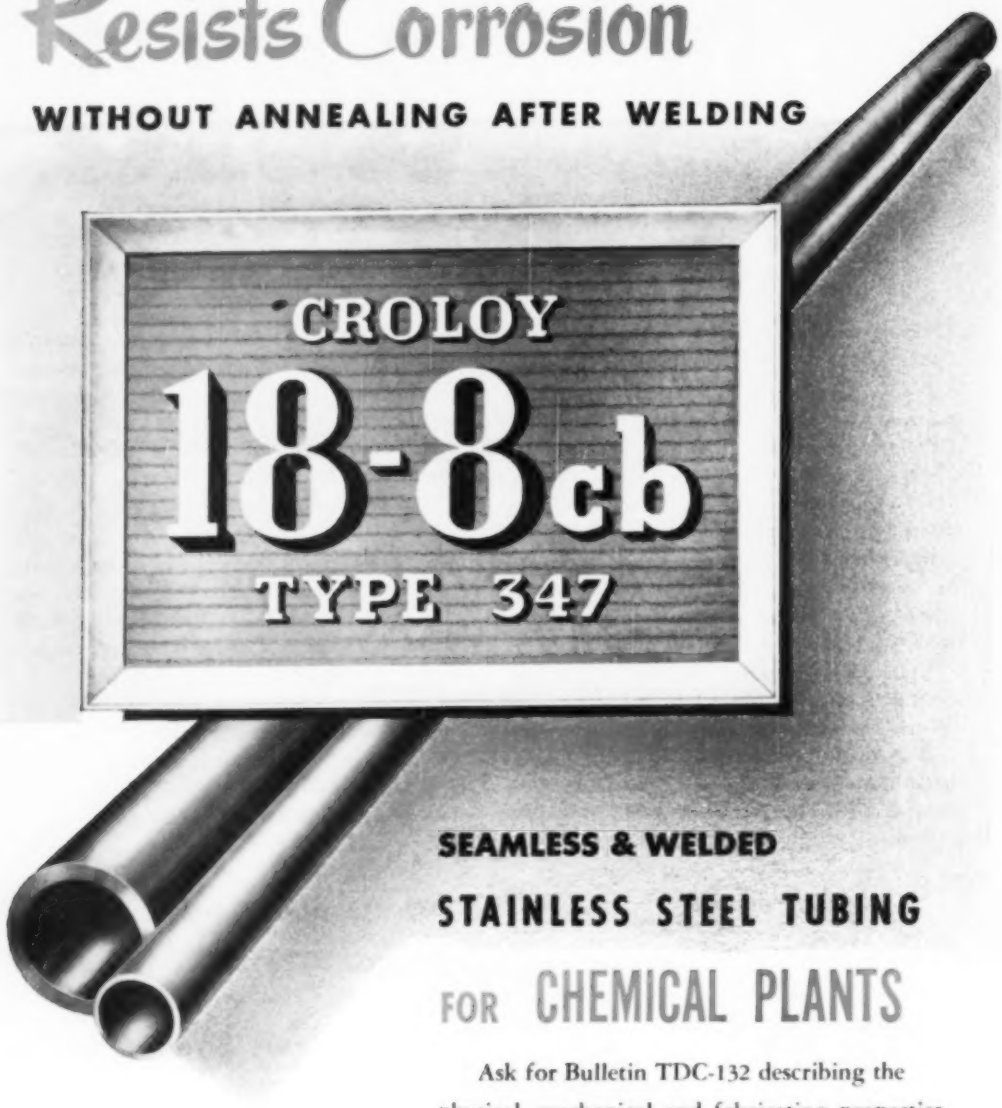
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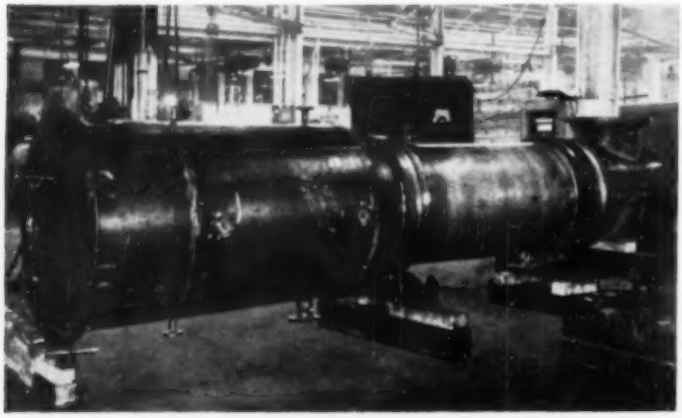
# What Metals would you

WHEN SPECIFYING MATERIALS for the construction of chemical or processing equipment, you deal with such questions as ease of fabrication, corrosion resistance, thermal conductivity, strength, longevity, ultimate cost. What would be your choice of materials for the four types of equipment shown here?

As in these, and so many other cases, the answer can usually be found in the wide range of Anaconda Copper and Copper Alloys. To users, designers and fabricators of equipment, the services of our Technical Department are always available. So please feel free to consult us whenever you need assistance in finding the most appropriate metals for chemical or processing equipment use.

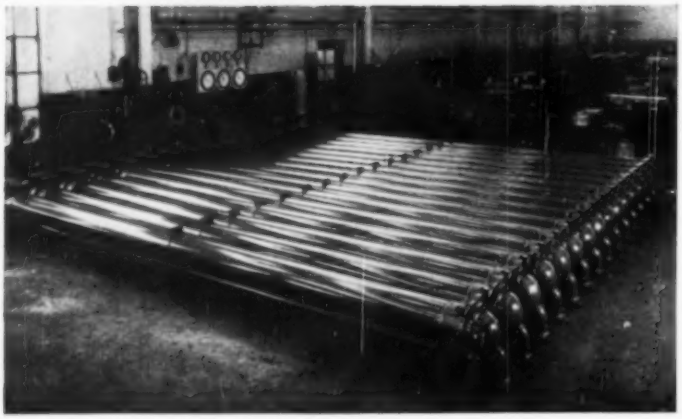
*Write for Publication B-2, on condenser and heat exchanger tubes and sheets, B-28 on Anaconda Alloys and E-5 on Everdur* Copper-Silicon Alloys.* 40170

*Reg. U. S. Pat. Off.



### For this Condenser—

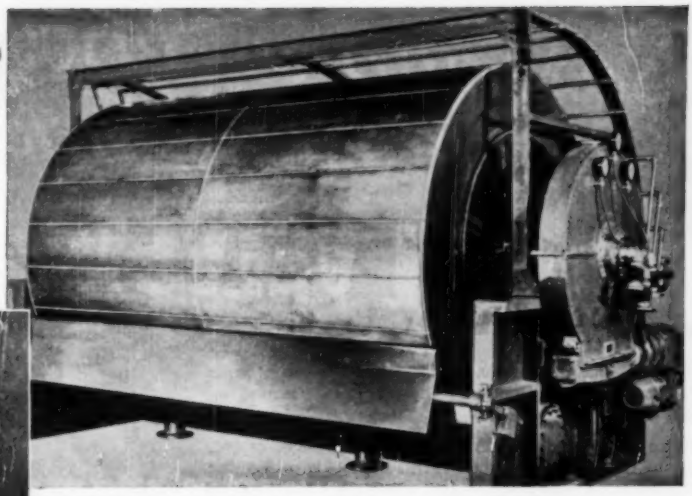
This 970 sq. ft. vertical condenser had to be substantially nonferrous for use in the production of synthetic organic chemicals. Of straight tube floating head design with an accumulator bottom, deoxidized copper was used for shell and tubes, Everdur for tube sheets and Muntz Metal for baffles. Condenser is shown in course of construction at The Whitlock Manufacturing Co. Plant, Hartford, Conn.

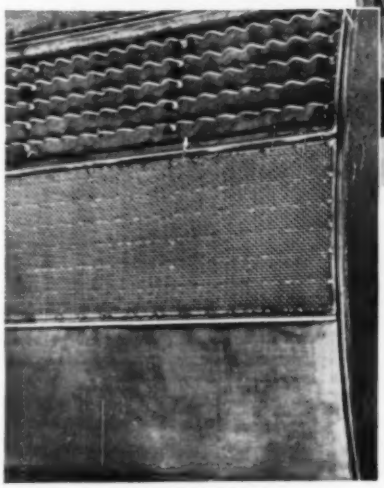


### For these Coolers—

Versatile corrosion resistance and high strength with minimum weight were the requirements for these Ross Type BCP lube oil and jacket water coolers for a variety of industrial machinery applications. The Anaconda materials for this job are: cold drawn seamless copper shells, Arsenical Admiralty tubes, Naval Brass tube sheets and brass baffles. Bonnets and hubs are cast bronze. Coolers are shown ready for shipment at Ross Heater & Mfg. Co. Inc., Buffalo, N. Y.

# choose?





***For this Filter***—In this Eimco Sugar Cane Mud Filter (Eimco Corporation, Salt Lake City, Utah) metals must provide ease of fabrication and high resistance to both mechanical wear and the corrosive action of filtrate and cake. The requirements are met by construction that is largely of Everdur Copper-Silicon Alloys—plus copper for filter plate and piping, brass for scraper drip sheet, pipe fittings and valves.

*Photo at left* shows outer construction of drum. Upper section: zig-zag deck supports of ¼" Everdur rod, spot welded to Everdur shell. Center section: screen of .093" Everdur 1010 wire, spot welded to division bars which are Everdur rectangular rod, machine grooved. Lower section: filter plate of perforated copper sheet, 625 holes to the square inch.



***For this Reaction Kettle—***

Economy—in easy fabrication and long, efficient, contamination-free operation—was the prime consideration in choosing Anaconda Electrolytic Copper for this large (20′ long, 10½′ in diameter) reaction kettle. Kettle is of ⅜" thick copper sheet, silver alloy brazed, and contains approximately 250 feet of 4" SPS copper pipe. It is shown at the plant of its builder, Process Engineering, Inc. of Somerville, Mass.

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Probably the chief reason why American Industry leads the world in productivity is the practice of setting up production goals—and then achieving them.

Naturally the achievement depends, to a large extent, on the human element; but in this technological age the efficiency of equipment—and especially flow control equipment—plays a major part.

That's why Powell builds a line of valves to meet the specific requirements of every known industrial flow control service. Furthermore, in every valve, long life and dependability have been emphasized.

So, no matter what your flow control problems may be, Powell has the answers. Write for full information on applications of Powell Valves.

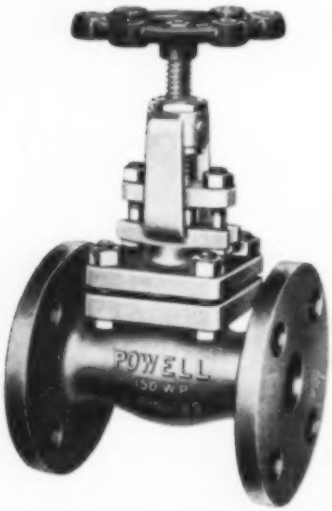



Fig. 1979—150-pound Stainless Steel Globe Valve with flanged ends, bolted flanged yoke-bonnet and outside screw stem.

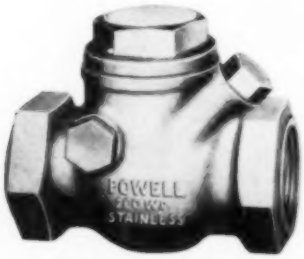



Fig. 1847—200-pound Stainless Steel Swing Check Valve with screwed-in cap and regrindable, renewable disc.




Fig. 375—200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable, wear-resisting "Powellium" nickel bronze disc.

# POWELL




Fig. 3003—Class 300-pound Cast Steel Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.




Fig. 1816—Large 125-pound All Iron Gate Valve. Made in sizes 2" to 30", incl. Has outside screw rising stem, bolted flanged yoke and tapered solid wedge. Tapered double wedge can be provided in sizes 2" to 12" incl.




Fig. 2051—150-pound Stainless Steel "Y" Valve with flanged ends, bolted flanged yoke and outside screw rising stem.

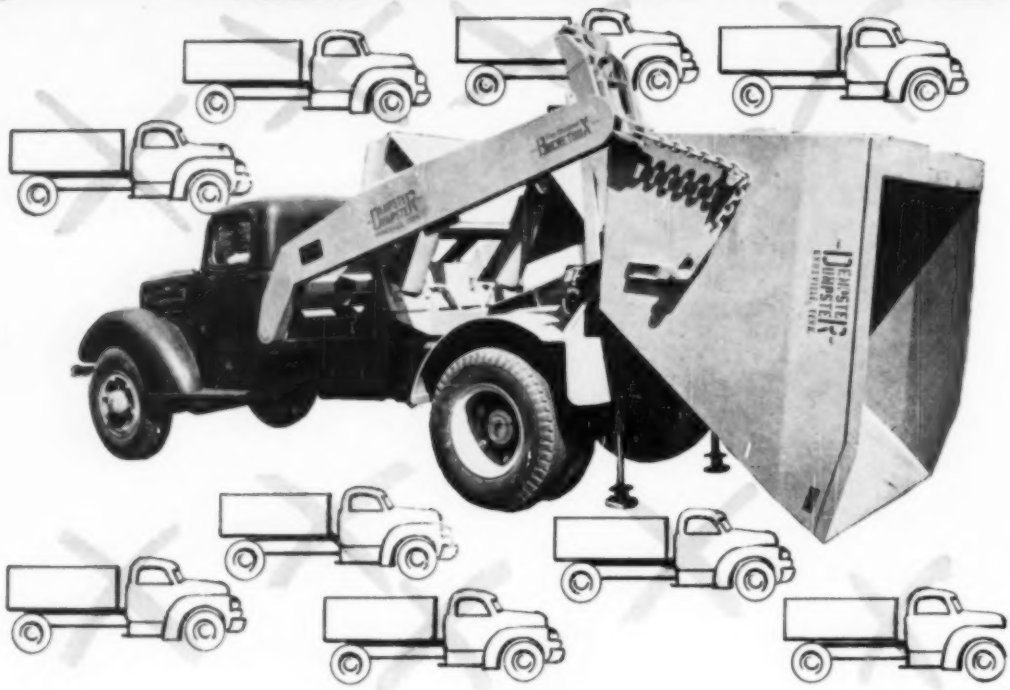
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**Cincinnati 22, Ohio**

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# VALVES

# One Dempster-Dumpster with 99




Being a large operation, this copper smelter required ten trucks and their crews, a series of push cars, a train car system and loading crews to handle over twenty different kinds of materials on relatively short hauls between plant buildings and outside of the grounds. The materials handled included, scrap of all descriptions, trash, rubbish, new and used brick, excavation spoil, waste oils, filter cake, dust, sand, gravel, cement, fire clay and many others.

A large majority of the handling, re-handling, storage, truck and car equipment and crews standing idle, was eliminated by the Dempster-Dumpster System. Simply stated, this system provides quick pick-up of pre-loaded containers for hauling, dumping or moving material to another location. The three pictures below show how it operates. The left illustration shows the Dempster-Dumpster truck hoisting unit approaching a loaded container. Two chains are attached and the driver returns to controls in the cab. In the center photo, loaded container is hydraulically raised into carrying position. Controls in the cab permit dumping as illustrated at right. You too, may be able to adapt the Dempster-Dumpster System of Materials Handling to your business at tremendous savings. Let one of our engineers discuss this possibility with you.

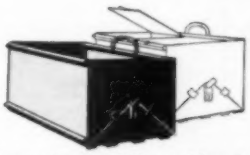


# Containers replaces 9 trucks....

## Over $50,000 saved annually . . . in this Copper Plant through faster, more efficient, materials handling

Here, in plain language, is what happened to Materials Handling costs after the Dempster-Dumpster System of Materials Handling was installed in a large Western copper smelting plant. A comprehensive Dempster-Dumpster survey had previously revealed costly delays, unnecessary handling and rehandling of materials, and much time wasted by loading crews. All have been eliminated to the tune of $50,000 savings annually. Fast pick-up, hauling and dumping of pre-loaded Dempster-Dumpster containers has replaced the old method of plant hauling. As a result, nine of the ten trucks formerly detailed for this work were eliminated or put on other work. Ninety-nine detachable containers, built in over 20 sizes and designs for the specific materials they were to handle, were spotted at material accumulation points throughout the plant. Some containers, provided with roller bearing casters, are rolled to indoor accumulation points. Some are handled by fork trucks, other by overhead cranes within plant buildings. As containers are filled, the Dempster-Dumpster truck hoisting unit and one man, the driver, picks each container up, hauls it to its destination, dumps it and returns the empty container for refilling or, loaded container is lowered at any point and left if desired. When you consider that pick-up and dumping of these detachable containers takes less than 60 seconds, and that the entire operation works to an on-the-run schedule, you will realize how one truck hoisting unit can handle 99 containers and do the work formerly requiring ten conventional trucks.

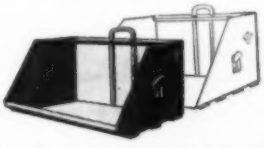
In the panel below are shown the basic types of Dempster-Dumpster Containers used in this installation. The basic containers can be altered with lids, casters, hose and chute connections, etc., to handle accumulations of any type material whether it be liquid, solid, dust, gas, light or heavy materials.



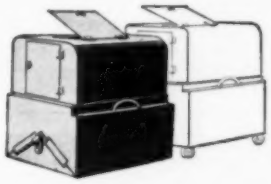
Forty-nine open top, drop-bottom containers in 3, 4, 8 and 10 cu. yd. capacities were spotted at 38 locations throughout the smelter operation. Four of these were 10 cu. yd. containers fitted with two end doors and a circular top opening for chute loading. Three of the 34—4 cu. yd. drop-bottom containers in this group were equipped with self balancing spring lids for special use.



Ten water tight, Tilt-Type containers were required to handle liquids or moist materials. Four of these were open top of 1½, 3 and 4 cu. yd. capacities for four locations. One 4 cu. yd. container with self balancing spring lids was provided at Lab Sample Mill. Three containers, with self balancing lids provided with pipe inlets, were supplied for receiving waste oil at three separate locations. Two 3 cu. yd. containers having three separate compartments with individual lids for each compartment, were required for the zinc electrolytic plant.



Two 4 cu. yd. skip-type, with lip, containers and two 4 cu. yd. skip-type, flat-bottom, containers were spotted at two locations. One 6 cu. yd. flat-bottom, skip-type container was furnished.



Thirty-three Universal-type containers in 6 and 10 cu. yd. capacities were spotted at 33 locations to receive trash, rubbish and other bulky materials. Two of these were mounted on roller bearing casters for movement to indoor loading locations.



Two 10 cu. yd. Apartment-type containers were spotted at the main office and laboratory office to receive large accumulations of waste paper and trash.

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*Direct Mail Division*

330 West 42nd Street New York, 18, N. Y.

One of a series *of messages to help you increase your understanding of business paper advertising, and its effect on your job.*

# Does your advertising manager rate an invitation to the management table?

IF YOU SHOULD ASK *him*, he'd probably say "yes." And his reasoning might run something like this:

Management's first responsibility is to show a fair profit. This requires a relentless search for continued improvement – in design, in purchasing, in production, research and cost-accounting. Each deserves its place at the management table. Yet none of these activities can actually create a dollar of profit, for the simple reason that you can't *produce* anything at a profit – not unless you can also *sell* it.

And that's what makes the advertising manager's job so important.

His first responsibility is to see that your company's products are made familiar (and desirable) to the greatest number of prospects, at the lowest possible cost. In fulfilling this responsibility, he sets a parallel course with the sales department, although his approach more closely resembles that of the assembly line technician.

For advertising, as he sees it, is simply the application of assembly line techniques to the *manufacture of a sale*. Just consider the five basic steps involved:

1. **Seeking out prospects**
2. **Arousing their interest**
3. **Creating a preference for your product**
4. **Making a specific proposal**
5. **Closing the order**

By *mechanizing* the first three of those steps, advertising increases management's chance to show a profit. It leaves your salesmen free to concentrate on the two jobs which they alone can do, and do best.

And nowhere does this mechanizing process operate more efficiently than in the business press, where it reaches your best prospects at the lowest possible cost.

Perhaps that's why so many smart advertising managers are partial to business paper advertising – and why more of them, incidentally, are getting to sit at the management table!

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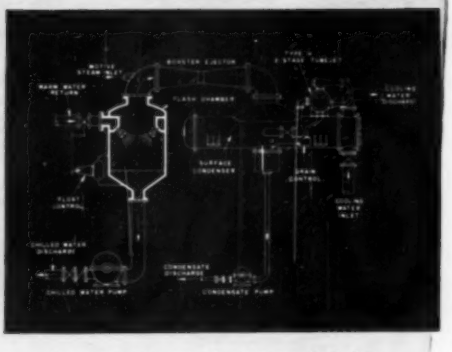


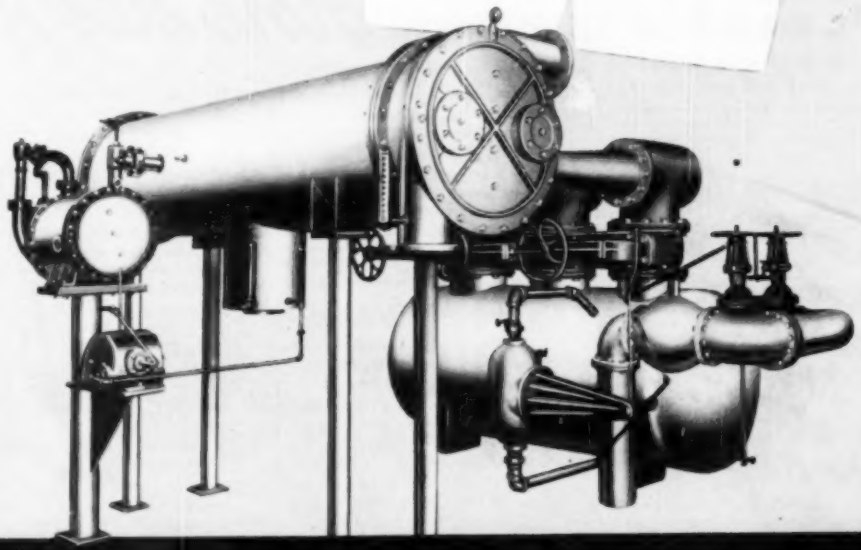
Diagram above and photograph below show C. H. Wheeler Steam Jet Vacuum Refrigeration System employing a Surface Condenser. Low Level Jet and Barometric Jet (Direct Contact) Condensers are also used, depending on the installation requirements.

# Steam Jet Vacuum Refrigeration

## Lowest Cost—In Every Way

Industrial Steam Jet Vacuum Refrigeration Systems, when compared with mechanical types of refrigeration, are lowest in purchase price, lowest in installation cost, and lowest in maintenance. Operation is simple and service life is long. Water is the refrigerant, thus the hazards of noxious or poisonous ammonia, sulphur dioxide, carbon dioxide, etc., are eliminated. Cooling is by the well-known basic principle of Flash Evaporation, using exhaust or live steam, as fully explained in our Catalog No. 1462, sent on request. C. H. WHEELER Steam Jet Vacuum Refrigeration Systems can be applied successfully to the chilling of water for finishing rolls in the paper and rubber industries, for sulphite mills and other places employing acid recovery apparatus of the absorption type, for supplying cold water for distillation processes in oil refineries, etc. Write for more information about its application to your cooling problem.

**C. H. WHEELER MANUFACTURING CO.**
**1808 Sedgley Avenue, Philadelphia 32, Pa.**
REPRESENTATIVES IN MOST PRINCIPAL CITIES



C.H. Wheeler OF PHILADELPHIA

STEAM CONDENSERS • WATER COOLING TOWERS
EJECTORS • STEAM JET VACUUM REFRIGERATION

If there's dust on it . . . it may be

# Heavy Scrap



# If it's HEAVY SCRAP

## it's needed to make *more steel!*




One half of all the raw material used in steel plants (and foundries, too) is *scrap.*

Today, the scrap we're getting does not include enough *heavy* scrap. *More* heavy scrap is needed to produce better steel *faster.*

And what is heavy *scrap?*

Heavy scrap is three things:

*1. the "left-overs" of iron and steel production, fabrication and machining.*

*2. junked autos and farm machinery.*

*3. obsolete iron and steel equipment in factories, such as old machinery, dies, jigs, fixtures, chain, etc.*

But—the "left-overs" are not great enough today to fill the unprecedented demands for production.

And, with replacements scarce, less junked autos and farm machinery have entered the scrap supply line.

So—only by digging out all the never-to-be-used odds and ends of broken, worn-out, and obsolete factory equipment . . . can the mills and foundries get all the heavy scrap they need—the type that makes better steel—and faster.

It's *your* job to do this.

Institute a steel scrap salvage program in your plant. Appoint one top official of your company to take full responsibility. Have him consult with your trade association's Scrap Drive Committee and local scrap dealers.

Do this now.

We do not have enough heavy scrap to take care of domestic needs and ERP . . . let alone an emergency reserve for national security.

*More* heavy scrap . . . one million tons of it . . . is the answer.

A PUBLIC SERVICE PROJECT OF THE ADVERTISING COUNCIL

**CHEMICAL ENGINEERING**

**WANTED—CHEMICAL ENGINEER**

or CHEMIST with Master's degree for appointment to Government Bureau-sponsoring project with opportunity for credit for research toward Ph.D in chemical engineering in large eastern university. Excellent opportunity for graduate study with salary of $200 per month. Send complete information education and experience. Reply

P-8260, Chemical Engineering
330 West 42nd Street, New York 18, N. Y.

*REPLIES (Box No.): Address to office nearest you*
*NEW YORK: 330 W. 42nd St. (18)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*

## POSITIONS VACANT

POST OF Works Superintendent in an Electrolytic Caustic Soda and Chlorine Plant situated abroad in the East. Applicant should be well qualified and considerably experienced in running, maintenance and development. He should preferably be conversant with the problems of Chlorine utilization and should be in a position to set up Pilot Plant and conduct operation leading to full development of chlorinated products—both organic and inorganic. Applications will be treated in strict confidence. P-7467, Chemical Engineering.

CHEMIST OR Chemical Engineer — having some specialized knowledge of or broad interest in fuels technology and chemical industry, as career assistant to Chief of Technical-Information Section in Research Department of a large company located in the Middle Atlantic Region. Excellent opportunity for a young man, preferably under 35, having a reading knowledge of German and/or French and ability to search the literature and prepare summarized reports. Give full details of education, experience, references and salary expected. P 8039, Chemical Engineering.

## SELLING OPPORTUNITIES WANTED

REPRESENTATIVES—FAMILIAR with chemical trade to sell tank lining, fabricated equipment, heating devices, on commission basis. Territories open—Texas, Tennessee, St. Louis, Chicago, by an established Ohio firm. RW 8079, Chemical Engineering.

## EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$25,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service. (39 years recognized standing and reputation). The procedure of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 260 Dun Bldg., Buffalo 2, N. Y.

EXECUTIVES $3,000-$25,000. This reliable service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. B, 241 Orange St., New Haven, Conn.

## POSITIONS WANTED

DEVELOPMENT ENGINEER for Rubber and Plastics—capable of initiating and carrying through to production new products, processes, equipment, mold design. Chemical engineering degree (1938) with diversified mechanical experience. PW 7952, Chemical Engineering.

(Continued on the following page)

PAINT FORMULATOR—EAST ..... $7500
CHEM. ENGRS.—PAPER—MID-WEST .. $350
RUBBER CHEMISTS—SUPTS. ..... $500
LEATHER CHEMIST—EAST ..... $450
PHYSICIST—X-RAY EXP. ..... $500
GRAD. CHEMS.—CHEM. ENGRS. $300 UP
*Inquiry Invited—Strictly Confidential*
SHAY AGENCIES
30 W. Washington Chicago 2, Ill.

**CHEMICAL ENGINEERS**
*We need Jrs. & Srs. with degrees.*
TECHNICAL LIBRARIAN-head dept. . . $5400.
EQUIP. DSGN. Chem. Eng. Degree . . . 7500.
DIR. DEVELOP. Ph.D ..... 8400.
*Call or Write GLADYS HUNTING*
CASTLE & ASSOCIATES, INC.
220 S. State St. Chicago 4, Ill.

# SEARCHLIGHT SECTION

*(Classified Advertising)*

EMPLOYMENT : BUSINESS : **"OPPORTUNITIES"** : EQUIPMENT : USE OR RESALE

UNDISPLAYED ——RATES—— DISPLAYED

*(Not available for equipment advertising)*

$1.20 per line, minimum 4 lines. To figure advance payment count 5 average words as a line.

Individual Employment Wanted undisplayed advertising rate is one-half of above rate, payable in advance.

Box Numbers—Care of publication New York, Chicago or San Francisco offices count as one line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

*Individual Spaces* with border rules for prominent display of advertisement.

The advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

*An advertising inch* is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

C.E.

*EXPERIENCED*

## Chemical Engineer

**To direct group activities covering: Collection and correlation of pilot plant data; pilot plant design and operating program; planning and execution of special engineering studies.**

**Experience in above work essential.**

**Present program is on production of synthesis gas from coal and new development in coal carbonization.**

**Replies including experience, salary required, and photograph should be directed to:**

**G. C. GAMBS, Manager**
**Service Department**
**Research and Development Division**
**Pittsburgh Consolidation Coal Co.**
**Library, Pennsylvania**

## TECHNICAL AND RESEARCH ENGINEER

**Excellent opportunity for creative and research minded engineer with well established rubber company where his new ideas, inspirational and organizational qualifications will permit him to work with large group of technical and development engineers. This requires above average engineer. Age 30 to 40. Furnish complete information in first letter. Replies held in strict confidence.**

P-8177, Chemical Engineering
520 North Michigan Ave., Chicago 11, Ill.

## MANUFACTURER'S REPRESENTATIVE WANTED

**To represent manufacturer of specialized chemical equipment, tanks, heat exchangers, etc., fabricated in all types of materials, on local or national basis.**

RW-8187, Chemical Engineering
330 West 42nd Street, New York 18, N. Y.

## ENGINEERS . . .

- *CHEMICAL EQUIPMENT ENGINEER* for design of specialized chemical handling and measuring equipment. Mechanical background is essential.
- *VACUUM EQUIPMENT ENGINEER* for design and development of production vacuum equipment. Good physics and/or electrical background is desirable.
- *GLASS PROCESS ENGINEER* for production process development and control. Must have good background in mechanized glass handling problems.
- *INDUSTRIAL ENGINEER (SAFETY)* to set up and administer safety program for the factory. Must be acquainted with chemical, mechanical, and electrical hazards.

*Mail resume outlining age, status, education, experience and salary requirements to:*

*Personnel Director*
**THE RAULAND CORP.**
**4245 N. Knox Ave., Chicago 41, Ill.**

## WANTED SALES ENGINEER

**New England manufacturer of industrial instruments offers permanent home office position to graduate mechanical or chemical engineer having actual field experience with process instrumentation. Position involves application engineering, sales correspondence, infrequent traveling. Selling experience helpful but not required. Members of our organization know of this advertisement. Write fully, detailing education and experience.**

P-7555, Chemical Engineering,
330 West 42nd Street, New York 18, N. Y.

## WANTED Representatives

**Established sales agent representatives. Individually assigned territories throughout country. Commission basis. Knowledge materials handling, pneumatic conveying, dust collecting, patented equipment and other related machines for process industries. An old established firm of Engineers and Manufacturers. Reply in detail.**

RW-7509, Chemical Engineering
330 West 42nd Street, New York 18, N. Y.

# SEARCHLIGHT SECTION

## POSITIONS WANTED
(Continued from the preceding page)

CHEMICAL ENGINEER B Ch E Cincinnati. Age 25, married, ex army officer, 2 years experience as a co-operative student. Will graduate in June. Desire a permanent position in development or production. PW 8258, Chemical Engineering.

CHEMICAL ENGINEER, B.S. degree, 16 yrs. diversified industrial experience; equipment layout and design, process studies and improvement, production supervision, process development. Sound engineering background, accustomed to responsibility and very thorough in approach to problems. Desire permanent responsible position with progressive organization. PW 8199, Chemical Engineering.

TECHNICAL SALES: 1941 Graduate Chemical Engineer with 5 years technical sales experience, Certified Professional Engineer. Member honorary and professional societies. Present salary $6,000. PW 7991, Chemical Engineering.

CHEMICAL ENGINEER, 34, with varied Design and Production Experience on Hydrometallurgy, unique experience of large scale production of pure Cobalt and Tungsten; Petroleum Refining and General Chemical work, seeks suitable position, preferably to design and commission new plant. British National, at present in England, but wishes to work in U. S. PW 8130, Chemical Engineering.

YOUNG BRITISH graduate chemical and mechanical engineering seeks opportunity for one year's training and experience with American employer. PW 8137, Chemical Engineering.

FIRE PROTECTION—Safety Engineer. Technical Graduate. Insurance company training and experience. Fifteen years experience with large industrial organizations, desires position with large corporation to organize and supervise safety program and to reduce insurance rates by installing modern fire protection equipment. PW 8013, Chemical Engineering.

MECHANICAL ENGINEER (52) Technical graduate, desires position as assistant to busy executive to assume full responsibility for plant rehabilitation, production and reducing operating costs. 30 years experience in Chemical and Food Industries. PW 8188, Chemical Engineering.

ENGINEER-WRITER—Available shortly for responsible position as "write" arm of sales or adv. mgr. Can create and develop profitwise sales promotion, products publicity, public relations. ChE grad., 30, exp. in plastics, prep. of handbooks, sales letters, speeches, direct mail—words that do the job! East Coast pref. PW 8227, Chemical Engineering.

CHEMICAL ENGINEER—B.S.Ch.E. 1947. Age 29, married veteran. 4 years Boeing Aircraft engineering, 1 year radiation inspector Hanford atomic works, copper flotation mill, electronics. publications. Desire permanent position with opportunity, engineering design and development, in Pacific or Mid-West states. PW 8225, Chemical Engineering.

## CHEMICAL EXECUTIVE AVAILABLE

**Senior executive with diversified knowledge of salt, food and feed. General plant, products control, Chemical research and engineering experience. B.S. Degree. Available as Technical Director or Plant Manager.**

**PW-7889,** Chemical Engineering
520 North Michigan Ave., Chicago 11, Ill.

## MECHANICAL ENGINEER

**M.E., N.Y., P.E., age 40. 19 years experience Chemical industry; including design, construction, maintenance, 8 years in high executive capacity. Employed at present. Prefer South or Southwest. Salary expected $10,000.**

**PW 8030,** Chemical Engineering
330 West 42nd St., New York 18, N. Y.

## TOP GRADE CHEM. ENG.

**Wants to help chem. industry as consultant. Thoroughly experienced in all kind of engineering work.**

**PW-8216,** Chemical Engineering
330 West 42nd Street, New York 18, N. Y.

## POSITION WANTED

CHEMICAL ENGINEER good experience in production, development pharmaceuticals, veteran, married, graduate study engineering, chemistry, desires position for creative ability. PW 8246, Chemical Engineering.

## SELLING OPPORTUNITIES WANTED

ESTABLISHED MANUFACTURERS' Agent seeks additional representation New York metropolitan area. Interested in petroleum, chemical processing and industrial equipment. RA 7845, Chemical Engineering.

A RATED chemical firm established over half a century with its own warehouse in Jersey City (New York metropolitan area) wants to contact chemical manufacturer interested in establishing strong domestic and export outlet. RA 8213, Chemical Engineering.

AGENTS FOR Greece. We are now able to accept agencies in Greece for American firms, manufacturing chemical products. Contact Dr. Thalis Cassimatis, Chemist and Pharmacist, 4 Alipedu Street, Piraeus, Greece.

SALES ENGINEER, 52. Graduate mechanical experienced chemical engineering, desires Metropolitan New York representation of large industrial equipment. Twenty-five years sales experience. Broad contacts. Excellent engineering background. Salary or commission. SA 8012, Chemical Engineering.

CHEMICAL ENGINEER, B.S. Ch.E. '37. Age 34. Good background in Vegetable oil and Fatty Acid processing, pilot plant, and research. Experience includes supervision of lab. and development of new products. Desire change to Sales position because knowledge of oils and fats applications would be of value. SA 7941, Chemical Engineering.

## ESTABLISHED SALES AGENTS

**For manufacture of process equipment, mixing equipment, and agitators in the Detroit, Buffalo, Boston, Philadelphia, Houston-Dallas territories.**

**RA-8148,** Chemical Engineering
330 West 42nd Street, New York 18, N. Y.

## Are Construction Costs Holding Up Your Pacific Coast Expansion?

**Then this nationally known chemical processing firm near San Francisco may be able to help you. We have immediately available plant facilities for manufacturing, ample area for expansion, laboratory and personnel for research, development and technical service, facilities for packaging and handling, sales and distribution outlets. If you have a product to be manufactured, formulated, packaged or distributed on the Pacific Coast, contact**

**CW-8080,** Chemical Engineering
68 Post Street, San Francisco 4, Calif.

## STAINLESS STEEL SPECIALISTS

**STAMPED - FORMED - WELDED**
**STAINLESS STEEL PRODUCTS**

*Send drawings (Est. 60 Years)*

**C. W. CARLL SONS**
Cole & Linwood Sts. Trenton 8, N. J.

## AVAILABLE...

***RECOVERY FACILITIES***

**All types crude mixtures**
**DISTILLATION and EXTRACTION**
High Temperatre High Vacuum
Simple Distillation Difficult Fractionations
Separations of close-boiling liquids, isomers, and azeotropes our specialty
Drum Lots - Tank Cars

**TRULAND**

**CHEMICAL & ENGINEERING CO., INC.**
P. O. Box 426, Union, N. J. Unionville 3-7200

## FOR LEASE

# MODERN PLANT

**Formerly Operated By Western Electrochemical Company**

***This facility readily adaptable for electrolytic, electro-metallurgical and electro-chemical processing activities.***

* * *

**Steel and reinforced concrete building, 7000 feet of floor space.**

**Plant contains among other items: two Westinghouse Ignitron Rectifiers 1825 kw cont. rating 365 volts DC, 5000 Amp DC; 60 cycle, 3 phase; and two Westinghouse transformers for above rectifiers 2085 kva, 34500 volts, 5000 amp DC outlet; together with circuit breakers and all switch gear. The foregoing is a complete sub-station.**

* * *

**Also available for lease three other buildings at this location containing a total of 25,000 Sq. F. with spur. These buildings available with or without machinery and equipment listed on page 380 of this publication.**

*Write, wire, or phone . . . .*

**GREGORY ELECTRIC CO.**
**2630-50 E. Washington Blvd.**
**LOS ANGELES 23, CALIF.**
***Phone: Logan 8-2409***

# Wanted
## CHEMICAL PLANT
# CASH PAID

**BY** FOR CAPITAL STOCK or ASSETS
***large financially powerful diversified organisation wishing to add another enterprise to present holdings.***
***Existing Personnel Normally Retained***
***Box 1221 1474 B'way, N. Y. 18, N. Y.***

***Special Service***
**HIGHEST EFFICIENCY EDUCTORS**
**EJECTORS - PROPORTIONERS**

and Venturi devises for creating vacuums, etc. Top performance against high heads. No expensive, complicated mechanism necessary. Custom built to solve your specific problem. Will move or mix all fluids accurately. Excellent Navy rating.

ALADDIN PROPORTIONING EQUIPMENT CO.
119 West 57th St. New York 19, N. Y.

**BEWARE THE IDES OF MARCH!**
**BUY WHERE THE "ADS" SAY—**

# MAHONEY FOR MACHINERY

**NEW—USED—REBUILT**

**A NEW HIGH IN PERSONAL SERVICE**

"Machinery Shopping" for the Busy Plant Executive. We locate equipment you need or buyer for your surplus. "Finder's Fee Basis."

**PROCESSING - PACKAGING MATERIALS HANDLING**

**982 Stuyvesant Ave. Union, N. J.**

# "Consolidated" SLASHES PRICES AT NEWARK SHOPS!

**Save Money - Save Time - Come to Newark, N. J. and see our great, modern Rebuilding Shops using**

## MODERN TOOLS AND EQUIPMENT

**• • A few *SPECIALS* at Newark, N. J. • •**

**DRYERS**

1—Buffalo, Vacuum Shelf Dryer, 60" x 80", 20 shelves.
1—Louisville Steam Tube Dryer, 6' x 50'.
1—Direct Heat Rotary Dryer, 3'6" x 28'.
1—Rotary Vacuum Dryer, 5' x 33'.
1—Buffalo, Double Drum Atmos. Dryer, 32" x 72".

**CRUSHING & GRINDING, PULVERIZING**

1—Raymond 5-roll High Side, complete with motor and accessories.
2—Raymond No. 000 Pulverizers, and 1—No. 0000 Pulverizer.
1—Micro Pulverizer, 4TH, also 1—2TH.

**KETTLES**

3—7500 gal. Steel Kettles, with copper coils, closed, Agitated, 10' dia. x 12'6" deep, 15' overall height.
1—2000 gal. Steel Kettle, Jack., open top, Agit., 7' dia. x 7'6" deep.
1—1200 gal. Aluminum Kettle, Jack., Closed, 5' dia. x 8'6" deep.
20—250 gal. Copper, Jacketed, Kettles, Open Top, with stands, 50" dia. x 42" deep.

**CENTRIFUGALS**

2—48" Troy Steel Basket Centrifugals, with V-belt motor drive.

**FILTERS**

1—No. 12 Sweetland Filter, 4" centers, iron or copper leaves.
1—No. 10 Sweetland Filter, 2" centers, iron or copper leaves.
1—No. 5 Sweetland Filter, 2" centers, copper leaves.
1—8' x 12' Acid Proof Oliver Filter.
3—36" Sperry 60-plate Filter Press, cast iron, Recessed, center feed, open delivery, hydraulic closing.

**MIXERS**

2—Baker Perkins Mixers, size 17, Jacketed, 200 gallon.
1—W & P Mixer, size 16, unjacketed, 150 gallon.
8—Baker Perkins Mixers, size 15, jacketed, 100 gal.
1—W & P Mixer, size 12, jacketed, 20 gal.
1—1,000 lb. Stedman Drum Mixer, motor driven.

## LIQUIDATING MACHINERY EQUIPMENT ATLAS POWDER COMPANY

**COATED FABRICS DIVISION—STAMFORD, CONN.**

**MIXERS & COTTON CUTTERS**

2—J. H. Day 20 gal. Brighton Mixers, tight and loose pulley.
2—J. H. Day 40 gal. Change Can Mixers, tight and loose pulley.
1—Ross 50 gal. Mammouth Change Can Mixer, tight and loose pulley.

**TANKS**

30—Vert. and Horiz., riveted and welded, from 2,000 gals. to 12,000 gals.
7—Blue enamel lined, 30" x 36", 100 gal. each, bolted-on dished covers with 14" manhole, 3" bottom outlet, leg supports.

**RUBBER & PLASTICS COMPOUNDING**

1—Line of 4-20" x 48" Rubber Mills, complete with reduction drive, motor and controls.

1—Royle No. 3 Strainer, 4½" screw, right angle drive and motor.

**SCALES**

Assortment of 30 Toledo Dial Scales, Portable, Bench and Floor type, range 900 to 3000 lbs.

**PEBBLE MILLS & GRINDERS**

3—Colloid Mills, each directly connected to 2—Terry 10 HP 3000 RPM Steam Turbines.

*Send all inquiries to*
P. O. Box 1115
STAMFORD, CONN.

WANTED: YOUR IDLE MACHINERY
SEND US YOUR LIST NOW!

THE KEY TO SAVING TIME AND MONEY
CONSOLIDATED PRODUCTS COMPANY, INC.
15 Park Row, New York 7, N. Y.—Tel. BArclay 7-0600
Shops: 335 Doremus Ave., Newark, N. J. Cable Address: Equipment, N. Y.

WE BUY AND SELL SINGLE ITEMS TO COMPLETE PLANTS

# WE ARE LIQUIDATING THE MACHINERY AND EQUIPMENT OF PLANT FORMERLY OPERATED BY WESTERN ELECTROCHEMICAL CO. AT 2630-50 E. WASHINGTON BLVD., LOS ANGELES, CALIF.

## PUMPS

1—2" x 2" Corrisiron Centrifugal Pump with 7½ HP, Totally Enclosed Fan Cooled Motor, 440 Volt, 60 Cycle, 3 Phase AC
1—LC 6 2" x 2" Corrisiron Pump Complete with 7½ HP West. Motor, 220 Volt, 3 Phase, 60 cycle
4—1½" Neoprene Ods Pump with Mechanism attached thereto
4—1½" x 1½" Corrisiron Centr. Pump with 3 HP Motor, 440 V., 60 Cy., 3 Ph.
1—LC 6—2 x 1½" Corrisiron Pump Complete with 5 HP West. Splash Proof Motor, 220 Volt, 3 Phase, 60 Cycle
1—Duriron Model 40 Centrifugal Pump Direct Connected to 3 HP, 3 Ph, 60 Cy, 220/440 V, 1750 RPM, Drip Proof Ball Bearing Sterling Elec. Motor
3—2" Bilton Bryon Jackson Centrifugal Pump Integrally Mounted with 1—40 HP, 1750 RPM, 440 V, 3 Ph, 60 Cy, Sterling El. Splash Proof Motors
3—Corrisiron Centrifugal Pump 2" x 1½" with 7½ HP, Splash Proof Motor 440 Volt, 60 Cycle, 3 Phase AC
9—Duriron Model 40 Centrifugal Pump Direct Connected to 7½ HP, 3 Phase 60 Cycle, 220/440 Volt, 1750 RPM, Drip Proof Ball Bearing Sterling Electric Motor Type KF
1—Durichlor Model 40 Centrifugal Pump with Totally Enclosed Fan Cooled Ball Bearing G.E. Motor Type K
1—Durichlor Model 40 Cent. Pump with Drip Proof Ball Bearing Sterling Motor
6—Durichlor Centrifugal Pumps X 2 MD-74-2"x1½" Electric Motors, 2 H.P. 3 Phase, 60 Cycle, 220/440 Volts, 1800 RPM, Totally Enclosed Fan Cooled Ballbearing Frame
6—Durichlor Centrifugal Pumps X2 MC-62-1½"x1½", Electric Motors, 2 H.P. 3 Phase, 60 Cycle, 220/440 Volts, 1800 RPM, Totally Enclosed Fan Cooled Ball Bearing Frame
1—2" x 1½" Corrisiron Centrifugal Pump with 3 HP Splash Proof Motor, 440 Volt, 60 Cycle, 3 Phase AC
5—Duriron Model 40 Series 76 Centrifugal Pumps Direct Connected to 3 HP, 3 Phase, 60 Cycle, 220/440 Volt, 1750 RPM, Drip Proof Ball Bearing Sterling Electric Motors Type KF
2—3" Bronze Fitted Pumps Directly Conn to 2-10 HP, 1700 Cy, 220 V, 3 Ph Motors
1—Bracket Pump #1135 Driven By One 3 HP, 3 Phase, 60 Cycle, 220/440 Volt 1800 RPM, GE Motor 6271465
1—Nash Hytor Vacuum Pump with 5 HP Motor

## TANKS

3—Steel Tanks 120" Diameter x 14' High Amercoat Lining with 36" Ni-Resist Turbine Agitator Driven By 7½ HP Sterling Slo-Speed Motors
3—Steel Tank 8'0" Diameter x 6' High Amercoat Lining with 24" Ni-Resist Turbine Agitator with Sterling Slo-Speed Motors
2—Steel Precipitator Tank 8' Diameter x 7' High, Amercoat Lining with 24" Ni-Resist Turbine Agitator with Sterling Slo-Speed Motors
2—Thickener Steel Tank 10' Diameter x 6' High, Amercoat Lining with Type A Derr, Thickener Mechanism including One HP Drive Unit and Gear Motor and 2" Type VN Durco Pump Including ½ HP Drive Unit
1—Steel Dorr Clarifleculator Tank 10' Diameter x 7' 0" High Amercoat Lining with 1 Door Clarifleculator Mechanism including 2 Speed Drive Head Gear Motor
1—Steel Clarifleculator Overflow Tank 15' Dia x 6'0" High Amercoat Lined
1—Steel Storage Tank 10' Diameter x 7' High, Amercoat Lining
1—10-B Stainless Steel Storage Bin Hopper, 10' x 2' x 7', Cu Ft Cap
2—Stainless Steel Filter Tanks 20" Diameter x 27" High with Wall Parous Filter Tubes
1—Nickle Clad Steel Dissolving Tank Flat Bond Concrete Bottom Complete with Agitator Drive and Agitator Drive Sliding Vertical Gear Head Motor 5 H.P. 3 Phase, 60 Cycle, 440 Volt, 90 RPM
1—Nickle Clad Salt Dissolver Tank 7'0" Diameter x 6' High with 24" M I Rosist Turbine Agitator Driven by 5 HP, 60 Cycle, 1800/84 RPM, 220/440 Volt, 284 Frame, Slow Speed Motor
2—Powder Standard 1000 Gallon Glass Lined Steel Tanks 1082 XL Series Complete with Anchor Agitator Motor Drive 7½ H.P., 3 Phase, 60 Cycle, 440 Volt, Explosion Proof Motor, Serial Numbers, 23249 and 23250
1—Structural Steel Storage Bin 10' x 10' 70 Ton Capacity
1—Goodrich Rubber Lined Acid Storage Tank, Capacity 1625 Gallons
1—25,000# Storage Tank, 7'0" x 7'0" x 10' High with Number 3 MC Jeffry Traylor Electric Vibrating Feeder
1—1625 Gallon Goodrich Vulkx Lock HCL Storage Tank Complete with Rubber Lining and Safety Heads with Safety Head Diaphragms
1—Redwood HCL Supply Tank 60" Diameter x 5' High
2—Steel Feed Tanks 120" Diameter x 14' High Amercoat Lining
2—Steel Feed Tanks 84" Diameter 9' High Amercoat Lining
4—Steel Effluent Storage Tanks 84" Diameter x 9' High Amercoat Lining
2—Steel Sump Tanks 4' x 5' x 3' with Transite Covers
2—Steel Sump Tanks 3' x 8' x 3' with Chemstone Covers and Amercoat Lining
1—8' x 10' x 10' Rect. Steel Tank with 3/16" Rubber By Goodrich

## PACKING MACHINERY

1—7" Vertical Redlar Runaround Conveyor, 60' Horizontal Length x 21' Vert Complete with Drive and Motor and Equip Incidental Thereto
1—10,000 # Welded Steel Blender, 1650 Cubic Foot Capacity with 7½ HP Driver, V 75 Electric Vibrator and Controller
1—#3 Special Low Head Jeffry Traylor Electric Barrel Packer, 440 Volt, 3 Ph, 60 Cy, Complete with One Toledo Floor Scale with 30" x 40" Platform
1—V-75 Citron Electric Vibrator Complete with Controller
1—14" x 12" Style #1 S.A. Enclosed Type Rotary Vane Feeder 1½ Cubic Foot Capacity at 1 RPM Complete with ¼ HP Jannette Motoreducer and Sprocket and Chain
1—6" Diameter x 22' Long Screw Conveyor at 25 RPM Complete with Shaft Coupling and Drive
1—25,000 Capacity Weigh Bin Approximately 7'0" x 7'0" x 13'0" High with Double Hopper Bottom Complete with Jeffry Traylor Electric Vibrating Feeders, Toledo Hopper Scale, Automatic Bin, Level Switch and Motors
3—V-50 Citron Electric Vibrators 110 V, 60 Cy, Complete with Controller
1—#10 Impeller Mill Including Hopper from Dryer to Grinder and Feeder Driven by Sterling Motor, 20 H.P., 2 Phase, 1800 RPM, 60 Cycle 220/440 Volts, Serial Number—125642
2—5" x 5'-7" Centrifugal Discharge Bucket Elevators, Approximately 18' Center Complete with ¼ HP Motor Drive

## CRYSTALLIZERS

2—Jacketed Nickle Clad Steel Crystalizing Tanks with Fittings; Dished Head, Concrete Bottom, Agitator and Agitator Drive Equipped with Sterling Vertical Gear Head Motor, 3 Phase, 5 HP, 60 Cycle, 440 Volt
2—Crystallizer 40' Long Swanson-Walker Single Deck and Continuous Crystallizer of Steel and Cast Iron Construction Complete with All Connections Supports Agitator and Drives
2—Homogeneous Lead Lined Crystallizers Welded and Lead Lined with Two 24"-10 Blade Agitator Motors, Serial Numbers—139979 and 139981

## CENTRIFUGES

2—Tolhurst 40" Suspended Centrifugals D. M. D. of a Steel case Lined with Sheet Monel Bucket, with Monel Plate Valve, Monel Sleeve Driven by Two Speed Totally Enclosed Fan Cooled Motors, 450-700 RPM with Water Tight Two Speed Control, 4487, 3 Phase, 60 Cycle, Serial Numbers T 16139A and T 16139B
1—18" x 28" Bird Solid Bowl Centrifugal Filter of Monel Metal Construction and Complete with Explosion Proof Motor and Other Incidental Equipment

## COOLING TOWERS

1—Floor Induced Draft Cooling Tower, 31 x 19 x 33—25 H.P. Totally Enclosed Motor 1750 RPM, 440 V, 60 C, 3 Ph., together with Shafts and Pumps
1—Floor Cooling Tower, Aerator Type.

## DRYERS

1—Louisville Rotary Counter Current Direct Heat Dryer 30" x 30' Including Refractory and Insulation Lining for Combustion Chamber Exhaust Fan with 3 HP, 440 Volt, 3 Phase, 60 Cycle, Totally Enclosed Motor; Dust Collector with 1 HP, 440 Volt, 3 Phase, 60 Cycle, Totally Enclosed Ball Bearing Motor for Dryer Drive, Burner with ½ HP, 440 Volt, 3 Phase, 60 Cycle, Totally Enclosed Ball Bearing Motor
1—Sodium Perchlorate Dryer—Thermo Chemical Dryer Complete with Line Stainless Heaters

## MISCELLANEOUS

3—Heat Exchangers consisting of Pyrex tubing and steel pipe 577 sq. ft.—252 sq. ft. and 135 sq. ft. of surface welded steel frames.
2—Refrigeration Units—20 ton each, including compressors, condensers, brine coolers, ammonia devices, Pump and controls.
9—Duriron 255 exhaust fans with ½ HP, 3 Phase, 60 Cycle 220/440 Volt 1800 RPM General purpose drip proof Sterling motors.
Federal Laboratory Air Classifying Unit B-2 Equipped with 110 Volt Fan and Motor Screw Feeder and Copper Feed Hopper
2—75 H.P. #130 Boilers, 54" Shell Inside Diameter 18 Foot Shell Length ¾" Shell Thickness, 60 Tubes 3", One 1850 Gallon Fuel Tank, One Electric Drive Fuel Pump with Relief and By-Pass Valve
Westinghouse Generator, 100 KW, 140 Volt, 715 Amp., 870 RPM, Type SX Frame 180 Harr, 874 Direct Drive by WH Induction Motor, 870 RPM, 2200 Volts
2—5 Cubic Foot Skip Hoists Complete with 2 HP Motors Electric Control and Brake, Steel Frame and Stainless Steel Bucket
1—Budget Hoist Consists of Budget Frame 6-8 Electric Hoist with Standard 10' Lift, 440 Volt, 3 Phase, 60 Cycle, Serial Number-47455
1—Sodium Chlorate Liquid Clarifier with Dorr Clarifleculator Mechanism
1—S.A. Single Power Shovel Machine, Complete with Scoop Swivel Sheave Roller Chain Drive, 5 HP Motor Reducer and Standard Swinging Shovel Boom
1—Centrifugal Discharge Bucket Elevator, 8" x 5" x 33' Complete with Drive Belt and Buckets, Shafts and All Equipment Incidental Thereto.
1—8" x 5" x 39'7" Centrifugal Discharge Bucket Elevator Complete with Drive Belt and Buckets and Equipment Incidental Thereto.
1—Screw Conveyor 9" Diameter x 40'. 25 RPM Complete with Drive Shaft and All Equipment Incidental Thereto.
1—Steel Weigh Hopper, 5' x 5' x 6'0" High, Made of 3/16" Plate and Fitted with Toledo Model 2580 Suspension Hopper Scale Complete with Jingle Mercury Magnetic Cut Off, 10,000# Dial with 10# Graduations and 2A Jeffry Traylor Electric Vibrating Feeder 8" x 16"
1—Screw Conveyor, 9" Diameter by 15' @ 50 RPM Complete with Drive Shaft 1½ HP, Motoreducer, Sprocket Chain Conveyor Box and Incidental Equipment
1—Budget Electric Hoist K-16
1—Electro Lift Hoist, 3000# Capacity Lift, 20'
2—G.E. Ignitron Rectifiers 300 KW, Serial 5472-3, 250 Volts DC; 1200 Amp; 2300 Input Volts; 60 Cycle; 3 Phase—together with Switch Gear and Circuit Breakers.
2—G.E. Pyranol Rectifier Transformers for above Rectifiers, 353 KVA; Voltage Rating 2300-240, 3 Phase, 60 Cycle, Serial Nos. 6912131-2
1—9" x 30' Portable Screw Conveyor Approximately 25 T.P.H. Complete with Drive Couplings and Other Incidental Equipment
1—5" x 5" x 61'9" Centrifugal Discharge Bucket Elevator Consisting of Shaft Drive Belt and Buckets, Steel Elevator Feed Hopper and Other Incidental Mechanism
1—Steel Weigh Hopper 5' x 5' x 6'0" High with One Toledo Model 2580 Suspension Hopper Scale 10,000# Dial with 10# Graduations
1—8" x 5" x 19'10" Centrifugal Discharge Bucket Elevator Including Shaft Drive Belts and Buckets and Other Incidental Mechanism
1—S.A. Single Power Shovel Machine Complete with Scoop Swivel Sheave Wire Rope and 5 HP Motoreducer and Standard Swinging Shovel Boom
1—Steel Silo 10' Diameter x 52' High with 12" x 12" x 25' Steel Spout

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1—General Electric Vertical Gear Reduction. Output Speed 5 R.P.M.—7½ HP. G.E. totally enclosed Motor—220 volts—3 phase—60 cycle
1—D. O. James Bevel & Spur Gear Angle Drive Size 182 R.A. Ratio 76.2 to 1. Complete with 15 H.P. totally enclosed fan cooled motor 220 volt—3 phase—60 cycle magnetic switch and push button.
1—Falk Reduction Drive D.A. 1760 rpm. 3.54 HP. ratio 16.8 to 1 with 5 HP. 1760 rpm. 220 volt. 60 cycle. 3 phase motor horizontal, and mounted on cast iron base.
1—10 HP. 3 phase totally enclosed fan cooled vertical motor with Philly Gear reducer having low speed output of 425 RPM.

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1—Chicago Pneumatic 8"x8" 90 CFM @ 100# pressure.
1—GE Portable Air Compressor (on wheels) with tank, motor and control.
1—5½"x6½" Vertical Air Compressor.
1—Westinghouse Air Brake cross compound steam operated Air Compressor 150 CFM.
1—Chicago Pneumatic Air compressor 75 CFM @ 100 pounds.

**AUTOCLAVES**

1—42" dia. x 24'4" Vertical Forge Welded Steel 400 lbs. Pressure—1300 gals.
1—10' x 25' Vertical or Horizontal Forge Welded Steel Jacketed. 100 lbs. Pressure.

**BARREL PACKER**

1—Motor driven barrel packer, with screw conveyor, trough and hopper.

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1—3'6" x 5' Cylindrical Blender with Stands and Drive.

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Large quantity of high and low pressure, high and low capacity blowers and fans in stock.

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1—20" D x 45' long stack for above.
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1—Union Iron Works 444 HP Horizontal water tube boiler, 200# W.P.
1—7 HP Kane High Pressure Fire Tube Gas fired boiler.
1—30" O.D. x 6'10"—30 HP Vertical high pressure boiler with injector.

**CENTRIFUGAL**

1—30" Suspended King and Gerber with perforated bronze basket.
1—60" Perforated basket—rubber covered, with A. C. motors.

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1—Alberger Condenser—Size No. H208. 340-¾" copper tubes, 2 pass., C.I. body.
1—#2 Condenser 3' diameter x 8' high, 125-¼" tubes, steel body.
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Stock of screw, bucket and portable conveyors.

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1—Eli W. Blake 15" x 9" Eccentric Jaw Crusher. Belt Driven.
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1—Two roll crusher (One roll 22" dia.; one roll 6" dia.)
1—#13 Quaker City Crusher—pulley drive.

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1—36" Sweetland pressure filter.
1—24" x 24" Sperry one eye open delivery flush plate and frame filter press.
1—24" Shriver one eye open delivery filter press chassis only.
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1—42,500 gallon vertical steel tank — riveted.
1—"CECO" automatic carton sealer, model A3901-12 with motor.
1—24" Dia. x 21" deep "Day" kettle equipped with agitator drive. 40 gallon capacity.

**GUMMER**

1—Pony Labelrite table model motor driven gummer with single phase motor.

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1—Weston Model 44 Type C. Revolution Indicator 0-1200 RPM.
2—Brown Electric Pyrometers 1200 degrees to 2600 Degrees F.
1—Foxborough Recording Thermometer 0 to 100 degrees F.
1—Tycos straight stem, glass front separable socket thermometer.

**KETTLES**

2—50 gallon jacketed agitated open top C. I. kettles.
1—40 gallon jacketed copper kettle on C.I. stand.
1—28" dia. x 14" deep jacketed C.I. kettle with bolted-on C.I. cover.
1—32" dia. x 24" deep C.I. jacketed open top kettle—90 gallons capacity—on legs.
1—6' dia. x 10' deep, iron body with heating coil, agitator and drive. 3090 gal.
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1—6'9" x 8'6" deep iron body, Sulphonator, Propeller Agitator Drive. Tight and Loose Pulley Capacity 2000 gallons.
2—12" dia. x 3' deep, aluminum lined, jacketed agitator, drive, tight and loose pulley.
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1—Raymond & 1 Pulverizer with 25 HP motor and 50 HP motor driven fan.
1—#1 Gruendler Hammermill with 7½ HP A.C. motor.
1—6' x 6' Throop Silex Lined pebble Mill.
1—6' x 5' Porcelain lined pebble mill. T & L pulley drive.
1—Raymond #0 Pulverizer with 25 HP A.C. motor. Raymond 4-0 Pulverizer without motor.
1—Raymond #0000 Pulverizer—belt drives.
1—Raymond #0000 Pulverizer—motor driven, complete with dust collector, separator, cyclones, tubular ducts, steel frame work.
1—3' x 3' Abbe porcelain lined mill body, no doors, stands, bearing or drive.
1—"Briton" Hammermill with blower, screen and 25 HP. A.C. motor.
1—Gruendler 2 roll smooth crusher 18" x 10½" wide. Pulley drive to jack shaft.
1—24" dia. x 26" wide ball mill.
1—6' dia. x 20" deep Muller.
1—12" 30" Kent 3 Roller Mill.
1—16" x 48" Day 3 Roller Mill.
4—Lehmann 5 Roller Water Cooled Mill.

**MIXERS**

4—20"x48" (12 cu. ft.) single ribbon and paddle mixers complete with driven, fully enclosed A.C. motors and starters.
1—Jacketed body Tar Mixer.
1—Sprout Waldron Grain Mixer with 12" Auger spiral.
1—25 Gallon Jacketed single shaft agitated mixer.
1—20 Gallon Tilting Mixer. T & L Pulley drive.
1—J. H. Day Single Blade Mixer 30" W x 36" L.
1—J. H. Day "Hercules" 6 Barrel heavy duty, tilting type mixer with A.C. Motors.

**PUMPS**

1—DUMP #16 Nickel alloy pump 1½".
1—Roper steam jacketed gear pump #0,—2", Motor and starter.
2—250 Blackmer Rotary Pumps 50 GPM with 5 HP AC motors.
1—7½" x 4½" x 10" Worthington Duplex Steam Pump.
1—7½" x 5" 6" Worthington Duplex Steam Pump.
1—Wilfley 2" x 1½" 50/90 GPM @ 150' head centrifugal pump with 7½ HP AC motor.
Vacuum pumps, rotary, centrifugal and gear pumps in stock.

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1—American Carbonic Model V5-2 Refrigeration Unit Type C02—capacity 5 ton.

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1—1500# Portable platform scale (32" x 46½").
1—1000# Platform scale 8'6".

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1—5 foot dia. Gayco Separator, with motor drive.

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1—Bramhall Deane sterilizer (or disinfector). Inside dimensions 2'9" wide x 4' high x 7' long.

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1—Porter Multiple Jar Mill, 4—1 gal. jars.
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3—AT&M 48" stainless steel suspended, solid baskets, 30 HP motors.
4—AT&M 40" suspended, copper perforated baskets.
1—Fletcher 18" stainless steel, m.d.
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1—Sharples #6 Pressurcelite Centrifuge.
4—Sharples #6 Super Centrifuges, 2 HP.
3—Sharples #16 Vaportite Centrifuges, stainless bowls, 3 HP motors.

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2—Oliver 8'x8', 6'x12' Vacuum Rotary.
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5—Sperry 30"x30", 24"x24" Cast Iron.
4—Sperry Type 36"x36" Cast Iron P&F.
3—Sperry 42"x42" Aluminum P&F.
1—Sperry 36"x36" Wood P&F, 29 chambers, 1¼" cake.

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4—1600 gal. steel, closed, jacketed Tanks.
1—Struthers-Wells 400 gal. closed, jacketed, agitated Pressure Kettle, 5 HP.
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**1—Ruggles Cole Rotary Direct Heat Dryer 7½ x 60'.**

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1—Johnson Plate & Frame Filter Press, 36" x 36".
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1—Stainless Steel Storage Tank, 6,000 gallons.
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1—Plate Fabricators Jacketed Kettle, 400 gals. 75 PSI in jacket.
1—Kovin 200 gallon jacketed Kettle, 75 PSI, anchor type agitator.
1—5 gallon jacketed Kettle, 60 PSI in jacket.
1—Cast Iron Jacketed Kettle with agitator, 600 gallons.
1—2,200 gallon Jacketed Kettle with agitator.
1—Stainless Steel Jacketed Kettle, 220 gallons.
1—Nickel lined Jacketed Kettle, 4,000 gallons.
1—Blaw Knox Jacketed Agitated Autoclave, 3' x 4'2".
1—Patterson-Kelley Jacketed Kettle, 600 gallons, with agitator.
1—Pfaudler Glass-lined Kettle, 220 gallons.
1—Struthers Wells Jacketed Kettle, 120 gallons.
1—Duriron Kettle, 430 gallons.
2—Jacketed Kettles, 1100 gallons, 5½' x 5½'.
1—200 gallon Jacketed Kettle with agitator.
1—Jacketed Kettle 300 gallons with agitator.
1—400 gallon jacketed ktettle.
1—10 gallon lead lined jacketed Kettle.
1—Abbe Buhrstone lined Pebble Mill, 6' x 12', with Motor.
1—Abbe Silex-lined Pebble Mill #3½.
1—Abbe Silex-lined Pebble Mill, 8 gallons.
1—Patterson Porox-lined Pebble Mill, 48" dia. x 24".
1—Allis Chalmers Ball Mill 5'8" O.D. x 18', Silex lined.
1—Abbe Pebble Mill, 3' x 4'.
1—Crossley Porcelain lined Pebble Mill, 100 gallons.
3—Hardinge Conical Ball Mills, 8' x 30", 5' x 24", 6' x 22".
1—Farrell 2-roll Rubber Mill, 16" x 36".
1—Thropp 2-roll Rubber Mill, 16" x 30".
2—Smidth Iron Lined Tube Mills, 4' x 12'.
1—Abbe Tube Mill, 4½' x 15'.
3—Buffalo Drum Dryers, 5' x 12'.
1—Stokes Vacuum Dryer, 4' x 10'.
2—Stainless Steel Hersey Rotary Dryers, 30" x 16', 36" x 16'.
1—B & S Double Drum Atmospheric Dryer, 3' x 6'.



*The Gelb Girl—March 1949*

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**2—Shriver Filter Presses, 42" x 42", 46 chambers, hydraulic closing device.**
**2—Shriver Aluminum Filter Presses, 18" x 18", closed delivery, 13 plates and 12 frames.**
**1—Vallez Leb. Filter #2E.**
**1—Shriver Bronze Plate & Frame Filter Press, 18" x 18".**
**1—Shriver 42" x 42" Filter Press Skeleton.**
**2—Sweetland Filters #12.**
**5—Vallez #2B Filters, with Glass, Aluminum, Rubber covered and copper leaves.**

1—#2 Royle Extruder.
1—#1 Royle Plastic Extruder.
1—Ball & Jewell Rotary Cutter #½ with 5 HP Motor.
1—Ball & Jewell Rotary Cutter #½.
1—Ball & Jewell Cutter #2.
3—Munson #0 Rotary Cutters.
15—Sharples Super Pressurite Centrifuges with 3 HP Explosion Proof Motors.
1—Kent Pony Mixer, 30 gallons.
1—J. H. Day Powder Mixer, 400 lbs.
1—Kent Jacketed Powder Mixer, 800 lb. capacity.
2—J. H. Day Powder Mixers, 800 lbs. capacity.
3—Ross Pony Mixers, 45 gallons.
1—Ross Powder Mixer, 2,000 lb.
5—Simpson #0 Intensive Mixers, (NEW).
1—Fitzpatrick Comminuting Machine, Model D.
1—Mikro Pulverizer #2TH.
1—Cumberland Granulator, with 15 HP Motor.
15—Lummus and Struthers Wells Condensers 110' to 580 sq. ft.
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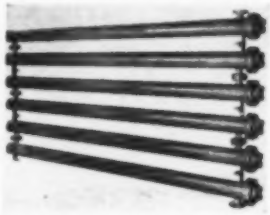
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# ADVERTISERS IN THIS ISSUE


Acme Copperamithing & Mach. Co. 186
Adams Co., Inc., R. P. 195
Aerofin Corp. 208
Allegheny Ludlum Steel Corp. 284
Allen Bradley Co. 347
Allis-Chalmers Mfg. Co. 12-13, 30, 72-73, 221, 321
Alloy Steel Products Co., Inc. 15
All Metal Screw Products Co. 340
Aluminum Co. of America 36, 179
American Air Filter Co., Inc. 230
American Brass Co. 366-367
American Car & Foundry Co., Valve Div. 365
American Machine & Fdry. Co. 297
American Gas Association 345
American Hard Rubber Co. 289
American Mach. Metals Inc., DeBothezat Fans Div. 234
Tolhurst Centrifugal Div. 200
American Metal Hose Branch, American Brass Co. 205
American Mineral Spirits Co. 341
American Optical Co. 6, 209
American Pulverizer Co. 336
American Tool & Mach. Co. 265
American Wheelabrator & Equip. Corp. 391
Amerail Co., Inc. 334
Archer Daniels Midland Co. 362-363
Arnold Co., A. H. 338
Atlas Powder Co. 335
Automatic Sprinkler Corp. of America 198
Automatic Switch Co. 314

Babcock & Wilcox Tube Co. 364
Badger & Sons Co., E. B. 77
Bagpak Div. of International Paper Co. 175
Bailey Meter Co. 279
Baird Assoc. Inc. 268
Baker & Co., Inc. 337
Baker Perkins, Inc. 41
Baldwin-Hill Co. 55
Barrett Div. Allied Chem. & Dye Corp. 327
Bell Telephone Laboratories 271
Bemis Bro. Bag Co. 219
Bethlehem Foundry & Mach. Co. 177
Biggs Boiler Works Co. 148
Bird Machine Co. 9
Black, Sivalls & Bryson Inc. 305
Blaisdell Pencil Co. 286
Blickman, Inc., S. 240
Boston Woven Hose & Rubber Co. 35
Bowen Engineering Inc. 234
Bridgeport Brass Co. 267
Bristol Co., The 241
Brown Instrument Co. 84-85
Brosites Machine Co., Inc. 247
Brown & Root Marine Operators Inc. 247
Buell Engrg. Co. 215
Buffalo Forge Co. 305
Buffalo Meter Co. 214
Buffalo Wire Works Co., Inc. 158
Buflovak Equip. Div. of Blaw-Knox Co. 39
Byron Jackson Co. 52

Cambridge Wire Cloth Co. 296
Carbide & Carbon Chemicals Corp. 5
Carpenter Steel Co. 315, 351
Cash Co., A. W. 143
Cash Valve Mfg. Co., A. W. 330
Catawissa Valve & Fittings Co. 254
Celanese Corp. of America 48
Cellulo Co. 390
Century Electric Co. 21
Chapman Valve Mfg. Co. 80
Chemical Construction Corp. 247
Chicago Bridge & Iron Co. 217
Chicago Metal Hose Corp. 355
Chicago Stainless Equipment Corp. 196
Clark Equip. Co., Ind. Truck Div. 278
Cleaver-Brooks Co. 163
Cole Mfg. Co., R. D. 324
Commercial Solvents Corp. 170
Consolidated Siphon Supply Co. Inc. 334
Cooper Alloy Fdry. Co. 257
Coppus Engrg. Corp. 361
Corning Glass Works 313
Cowles Co. 311
Crane Co. 49
Crouse Hinds Co. 54

Davis Engineering Corp. 58
DeBothezat Fans Div., American Mach. Metals Inc. 234
DeLaval Separator Co. 67
DeLaval Steam Turbine Co. 274, 309
Deming Co. 174
Dempster Bros. Inc. 370-371
Diamond Alkali Co. 277
Dicalite Div. Great Lakes Corp. 262
Dixie Machinery Mfg. Co. 256
Dodge Mfg. Corp. 229
Dorr Co. 220
Dow Chemical Co. 232
Dow Corning Corp. 172
Dracco Corp. 160
Duriron Co., Inc. 253

Ebasco Services Inc. 336
Electric Auto-Lite Co. 288
Elliott Co. 392
Enjay Co., Inc. 183
Eppenbach, Inc. 252
Esso Standard Oil Co. 203

Fairbanks, Morse & Co. 153
Farrell Birmingham Co., Inc. 45
Filtration Engineers, Inc. 88-89
Fletcher Works 306
Floridin Co. 162
Foster Wheeler Corp. 44
Foxboro Co. 37-38
Fuller Co. 333
Fulton-Sylphon Co. 49

Gardner Denver Co. 14
General Amer. Transp. Corp. 155, 282-283, 285
General Ceramics & Steatite Corp. 302
General Chemical Div. Allied Chemical & Dye Corp. 75
General Controls 288
General Electric 32-33, 64-65
General Machine Co. of New Jersey 312
Globe Steel Tubes Co. 51
Glycerine Producers Assoc. 273
Gordon Co., Claud S. 298
Goslin Birmingham Mfg. Co., Inc. 264
Goulds Pumps Inc. 304
Graphite Metallizing Corp. 292
Graver Tank & Mfg. Co. Inc. 389
Greene, Tweed & Co. 308
Grinnell Co., Inc. 166
Griscom Russell Co. 201

Hagan Corp. 275
Hammel-Dahl Co. 26
Hardinge Co., Inc. 342
Haveg Corp. 294
Haynes Stellite Co. 4
Hercules Powder Co. 69
Hays Corp. 30, 322
Hersey Mfg. Co. 258
Heyden Chemical Corp. 173
Hilliard Corp. 184
Homer Mfg. Co., Inc. 290
Homestead Valve Mfg. Co. 68
Hooker Electrochemical Co. 23
Howell Electric Motors Co. 81

Illinois Elec. Porcelain Co. 244
Industrial Process Engrs. 222
Infilco Inc. 215
Ingersoll Rand 66
International Engrg. Inc. 353
International Nickel Co. 207, 323
International Paper Co., Bagpak Div. 175

Jackson & Church Co. 276
Jeffrey Mfg. Co. 18
Jenkins Bros. 159
Johns-Manville 318

Keasbey & Mattison Co. 303
Kelley, O. G. & Co. 24-25
Kemp Mfg. Co., C. M. 293
Kennedy Valve Mfg. Co. 188
Kidde & Co., Inc., W. 42
Klein Filter & Mfg. Co. 344
Knight, Maurice A. 280

LaBour Co., Inc. 227
Lapp Insulator Co., Inc. 87
Lawrence Mach. & Pump Corp. 332
Lee Metal Products Co., Inc. 320
Leeds & Northrup Co. 360
Link Belt Co. 11
Liquidometer Corp. 330
Littleford Bros., Inc. 292
Lubriplate Div. Fiske Bros. Refining Co. 310
Lukens Steel Co. 8, 331
Lukenweld Div. Lukens Steel Co. 8
Lunkenheimer Co. 228
Luria Engineering Corp. 226
Manhein Mfg. & Belting Co. 241
Manning, Maxwell & Moore Inc. 294
Manning & Lewis Engrg. Co. 388
Marsh Stencil Machine Co. 372
Master Electric Co. 3rd Cover
McGraw-Hill Book Co. 300
Mears Kane Ofeldt, Inc. 322
Meriam Instrument Co. 164
Merrick Scale Mfg. Co. 372
Metal Products Corp. 300
Metal Glass Products Co. 224






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# ADVERTISERS IN THIS ISSUE


Metalsmiths Div. of Orange Roller Bearing Co. Inc. ..... 314
Metrotex Inc. ..... 340
Midwest Piping & Supply Co., Inc. ..... 249
Midvale Co. ..... 235
Mine Safety Appliances Co. ..... 60-61
Mitchell & Co., Inc., W. K. ..... 306
Mixing Equipment Co., Inc. ..... 261
Modine Mfg. Co. ..... 213
Monarch Mfg. Works Inc. ..... 356
Monsanto Chemical Co. ..... 82-83
Morris Machine Works ..... 202
Mt. Vernon Woodberry Mills ..... 40
Multi Metal Wire Cloth Co., Inc. ..... 326

Nash Engrg. Co. ..... 299
National Box & Lumber Co. ..... 308
National Carbon Co., Inc. ..... 250
National Engrg. Co. ..... 192
National Filter Media Co. ..... 216
National Lead Co. ..... 343
New England Tank & Tower Co. ..... 272
Niagara Blower Co. ..... 176
Nicholson & Co., W. H. ..... 286
Northern Indiana Brass Co. ..... 56
Nuken Products Corp. ..... 276
Norton Co. ..... 86
Norwalk Co., Inc. ..... 212

Ohio Injector Co. ..... 191
Oklahoma Planning & Resources Board ..... 180
Oliver United Filters Inc. ..... 92-93
Ozalid Div. General Aniline & Film Corp. ..... 359

Pangborn Corp. ..... 316
Packing Engrg. Corp. ..... 354
Pennsylvania Flexible Metallic Turbine Co. ..... 233
Pennsylvania Industrial Chem. Corp. 301
Pennsylvania Salt Mfg. Co. ..... 165
Permutit Co. ..... 57
Petro-Chem Development Co., Inc. ... 317
Pfaudler Co. ..... Back Cover
Pfizer & Co., Inc., Chas. ..... 348
Phila. Gear Works, Inc. ..... 281
Photoswitch Inc. ..... 326
Pipe Fabrication Institute ..... 34
Pittsburgh Coke & Chem. Co. ..... 79
Pittsburgh Lectrodryer Corp. ..... 357
Powell Co., Wm. ..... 368-369
Power Products Co. ..... 310
Pressed Steel Tank Co. ..... 211
Proctor & Schwartz Inc. ..... 189

Raymond Pulverizing Div. Combustion Engrg. Co., Inc. ..... 150
Reading Pratt & Cady Div. Amer. Chain & Cable Co. ..... 181
Reeves Pulley Co. ..... 33
Reliance Electric & Engineering Co. 291
Republic Steel Corp. ..... 43, 231
Revere Copper & Brass, Inc. ..... 10
Robins Conveyors Div. Hewitt-Robins Inc. ..... 295
Roots-Connersville Blower Corp. ..... 270
Roth Co., Roy E. ..... 390
R-S Products Corp. ..... 277
Ryerson & Son, Inc., J. T. ..... 94

Saran Pipe Co. ..... 232
Schneible Co., C. B. ..... 332
Schutte & Koerting Co. ..... 91
Sadberry Inc., J. B. ..... 260
Shell Chemical Corp. ..... 1
Shriver & Co., Inc., T. ..... 172
Sier Bath Gear & Pump Co., Inc. ..... 226
Signode Steel Strapping Co. ..... 47
Solvay Sales, Div., Allied Chem. & Dye Corp. ..... 185
Sparkler Mfg. Co. ..... 266
Spencer Chem. Co. ..... 296
Sperry & Co., D. R. ..... 328, 339
Syray Drying Service ..... 372
Sprout Waldron & Co. ..... 190
Stacey Bros. Gas Construction Co. .. 46
Standard Conveyor Co. ..... 218
Standard Oil Co. (Indiana) ..... 27
Standard Steel Corp. ..... 324
Stanley Co., Inc., Wm. W. ..... 288
Stearns Magnetic Mfg. Co. ..... 298
Steel & Tubes Div. Republic Steel Corp. ..... 43
Stokes Machine Co., F. J. ..... 16
Stokes & Smith Co. ..... 206
Sturtevant Div. Westinghouse Electric Corp. ..... 62-63
Sturtevant Mill Co. ..... 90
Superior Electric Co. ..... 210
Sutton, Steele & Steele, Inc. ..... 156
Swenson Evaporator Co. ..... 22

Taber Pump Co. ..... 320
Timken Roller Bearing Co., Roller Bearing Div. ..... 31
Tolhurst Centrifugals Div. Amer. Mach. & Metals Inc. ..... 200
Traylor Engrg. & Mfg. Co. ..... 169
Tube Turns Inc. ..... Second Cover

Union Asbestos & Rubber Co. ..... 290
Union Bag & Paper Corp. ..... 197
Union Carbide & Carbon Co. ..... 4, 5
U. S. Steel Supply Co. ..... 199
U. S. Industrial Chemical Inc. ..... 19-20
U. S. Rubber Co. ..... 329
U. S. Steel Co. ..... 259
U. S. Stoneware Co. ..... 70, 354

Vapor Recovery Systems Co. ..... 182
Victor Chemical Works ..... 248
Viking Pump Co. ..... 214
Virginia Smelting Co. ..... 288
Vogt Machine Co., Inc., Henry ..... 307
Vulcan Iron Works ..... 239

Walker Process Equip. Inc. ..... 328
Walworth Co. ..... 245
Weinman Pump Mfg. Co. ..... 178
Western States Machine Co. ..... 312
Westinghouse Electric Corp. ..... 28-29, 62-63
Weston Elec. Instrument Corp. ..... 238
Wheeler Insulated Wire Co., Inc. ..... 290
Wheeler Mfg. Co., C. H. ..... 375
Whitlock Mfg. Co. ..... 338
Wickwire Spencer Div. Colo. Fuel & Iron Corp. ..... 269
Wiegand Co., Edwin L. ..... 161
Wigton-Abbott Corp. ..... 255
Wilfley & Sons, A. R. ..... 157
Williams Pat. Crush. & Pulv. Co. ..... 246
Wilson Products, Inc. ..... 204
Wolverine Tube Div., Calumet & Necla Consolidated Copper Co. ..... 17
Wyandotte Chemical Corp. ..... 223

Yarnall Waring Co. ..... 59

PROFESSIONAL SERVICES ..... 374

SEARCHLIGHT SECTION
*(Classified Advertising)*

EMPLOYMENT
Positions Vacant ..... 377
Selling Opportunities Offered ..... 377
Positions Wanted ..... 377, 378
Selling Opportunities Wanted ..... 378
Employment Agencies ..... 377
Employment Services ..... 377
SPECIAL SERVICES
Contract Work ..... 378
BUSINESS OPPORTUNITIES
Offered ..... 378
PROPERTY
For Sale ..... 378
EQUIPMENT
Used or Surplus New ..... 378-387
WANTED
Equipment ..... 386
Miscellaneous ..... 379


## ADVERTISERS INDEX


Aladdin Proportioning Equipment Co., Inc. 378
American Air Compressor Corp. ..... 383
American Electrical Sales Co. Inc. ..... 384
Atlas Carbon & Clay Corp. ..... 385
Battle, H. W. ..... 386
Barcan Co., Irving ..... 384
Bauer, L. W. ..... 386
Brill Equipment Co. ..... 382
Carll Sons, Charles W. ..... 378
Castle & Associates Inc. ..... 377
Chemical & Process Machy. Corp. ..... 383
Chemical Service Corp. ..... 386
Consolidated Products Co., Inc. ..... 379
Darien Corp. ..... 386
Eagle Industries Inc. ..... 382
Electric Equipment Co. ..... 382
East Coast Valve & Fitting Co. Inc. ..... 386
Emsco Equipment Co. ..... 381
Equipment Finders Bureau ..... 386
First Machinery Corp. ..... 383
Gelb & Sons Inc., R. ..... 387
Gregory Electric Co. ..... 378, 380
Kehoe Machinery Corp., Lester ..... 383
Lawler Company ..... 382
Lestan Corp. ..... 385
Lewon Bros. ..... 384
Lobe Equipment Supply Co. ..... 384
Loeb & Son, H. ..... 382
Machy. & Equip. Corp., The ..... 385
Mahoney-Clarke Inc. ..... 386
Mahoney-Machinery ..... 378
Perry Equipment Corp. ..... 385
Plant Equipment Company ..... 384
Pittsburg Consolidated Coal Co. ..... 377
Rauland Corp. ..... 377
Shay Employment Agency ..... 373
Stanhope Inc., R. C. ..... 383
Stein Equipment Co. ..... 386
Thomson Soya Mill ..... 386
Thompson Co., J. Parker ..... 385
Tarr, W. ..... 384
Thermoid Co. ..... 382
Truland Chem. & Engrg. Co., Inc. ..... 378
Union Standard Equipment Co. ..... 384
Wagner Co., Arthur ..... 384

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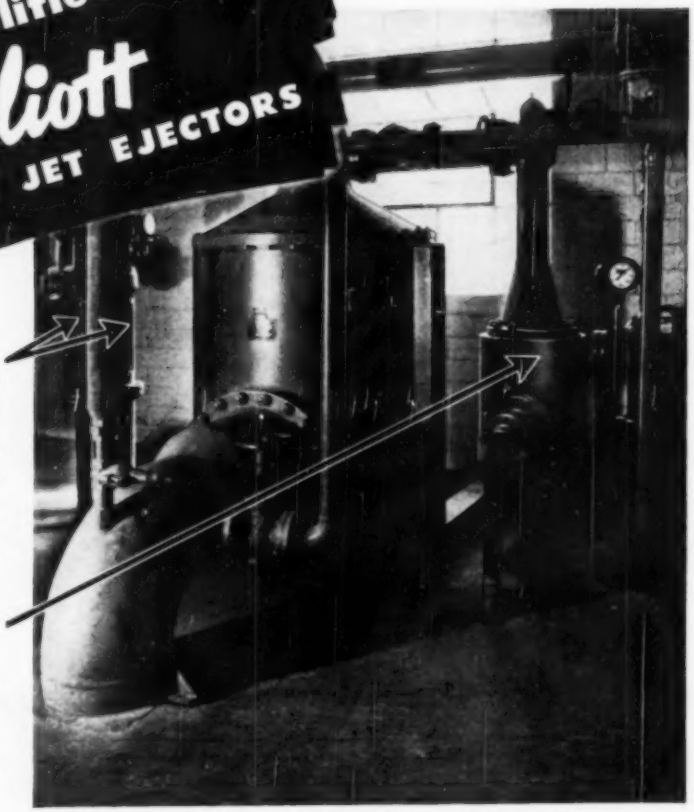


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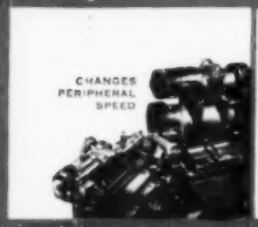
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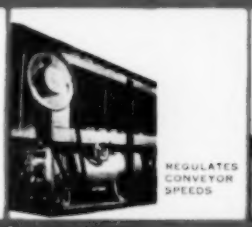
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These are only a few of the many, many types of applications where Master Speedrangers can help you do a better job. These Speedrangers with their stepless variable speed operation assure exactly the right speed for every operation . . . for each operator . . . the right speeds for each change in the consistency or shape of the material being processed. Such variable speed operation gives you plus value in higher rates of production, a better quality product and more efficient performance of your equipment and your operators.

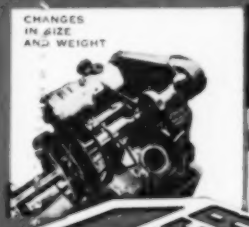
Master Speedrangers provide this infinitely variable speed in compact, all-metal, mechanical variable speed units in a wide range of types and in sizes up to 5 horsepower.

## variable speed operation helps you make a good job better

An extra feature of Master Speedrangers is their extreme flexibility, for they can be made to incorporate an electric motor, a variable speed unit, a gear reduction unit and an electric brake . . . all standard Master units that easily combine into a compact, integral power package. This provides exactly the RIGHT horsepower, the RIGHT range of speed, the RIGHT features, in a unit that you can use RIGHT where you want it.

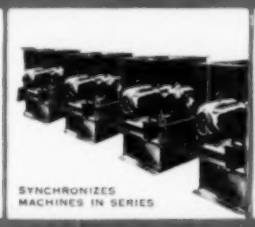
Write for Data 7525, a new 24-page book on Speedrangers, and see what a real job they can do for you.

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MASTER SPEEDRANGERS




These 20% stainless steel clad vessels are typical of the type of work done in Pfaudler shops.

## Pfaudler to bid on your stainless steel requirements

When you get a Pfaudler bid, you can be sure that the quotation is based on a job that gives you the best results over the long pull. That means engineering and building to high standards. Sure, it's always possible to shave prices by skimping on sound design and workmanship but you pay for it in the long run.

So take a leaf from the book of exacting buyers—people like DuPont, Merck, General Chemical, Hoffman-La-Roche, American Cyanamid and hundreds of others—and ask Pfaudler for a bid on your stainless steel requirements.

You get the benefit of long, diversified engineering experience which results in equipment that produces better yields, for example. Such problems as heat transfer, agitation, drives and finish are important to efficiency. There is no substitute for the right answer.

Well equipped shops and well-trained ASME code fabricators play their part in giving you what is needed to answer your requirements honestly. That's why users tell us that the life-cost ratio of Pfaudler stainless steel equipment is exceptional. It's to your advantage to let us quote on your next stainless steel requirement. Call any one of the offices listed.

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